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ABSTRACT

This study of the development of international data networks, a phenomena of the 1970's, and policy issues arising from their use is an in depth investigation of 24 private and six public European networks commissioned from Logica Limited and sponsored by the governments of France, Germany, the Netherlands, Norway, Spain, and Sweden. The report discusses reasons for using international data networks, describes their technological development, investigates transborder applications, presents access control and security problems and their solutions, and analyzes the costs and economics of international networks. The 27 conclusions presented range from the benefits of international data transmission to the participating companies, the involved nations, and the scientific research community to the developing international implications of mutual interdependence, and to the impact of costs on multinational corporations and smaller local users. Predicting that an European public network will be unavailable for at least five years, the report recommends that private networks receive preferential tariff treatment to meet the existing need of such a network. The appendices include descriptions of the 30 networks investigated, with diagrams, a checklist of information to be sought, the questionnaire used, and a checklist of information in network description. (RAO)

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The Usage of International Data Networks in Europe

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PREFACE

As part of its programme of work, the Working Party on Information, Computer and Communications Policy is looking into the development of international data networks and the policy issues arising from it. This report has been commissioned from Logica Limited, London, and sponsored by the governments of France, Germany, the Netherlands, Norway, Spain and Sweden. It contains the results and conclusions obtained by the Logica research team, following an in-depth investigation of 30 private and public data networks based in Europe. The views expressed are those of the authors and do not necessarily reflect those of the Organisation.

Special thanks are due to Logica Limited for their contribution towards improving the knowledge of the usage of the rapidly developing data networks in Europe, to the network operators for their co-operation in interviews and to the six Member countries who have made the study financially possible.

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PART 1

1. INTRODUCTION

1.1 The significance of international data transmission

The transmission of data over telecommunications circuits began in the 1950s, with the early airline and defence networks. The technology developed for these pioneering systems began to see wide application by the mid-1960s. Airline reservation networks and defence command and control networks again played a leading role, but other users began to be important, notably banking, corporate management, government and time-sharing bureaux. The airline and defence networks have had an international dimension almost from the beginning, but until the end of the 1960s other systems using data transmission were confined to a single country, with very few exceptions.

The growth of international data transmission is thus essentially a phenomenon of the 1970s. Arguably it is no different in kind from other means of transporting data between countries, as bundles of documents, boxes of punched cards, magnetic tapes or computer disks. However, the speed, accessibility and interactive capability provided by a direct communications link do make a qualitative difference to the way in which data can be shared and used, and to the interdependence of the parties at each end of the link. At the same time, the intangible nature of data transmission and the difficulty of monitoring what is being sent adds to concern over possible misuse and undesirable social and economic effects.

The Organisation for Economic Cooperation and Development has been taking a close interest in the growth of transborder data flows and their implications for several years. In common with other groups studying the issue, the Organisation has identified several issues raised by this traffic which could cause legitimate concern. These concerns fall into three broad areas, as follows:

- a) The privacy and security of personal and corporate data, particularly where it may be transported to or accessed from another country which may have lower standards of privacy and

security than the country where the data originates.

- b) The increasing international interdependence created by the sharing of data or computing resources between countries, and the resulting vulnerability of one country to events or decisions in another which are outside its control.
- c) The danger of the concentration of data processing facilities in some countries, with a resulting loss of economic opportunity and capability. Furthermore the vulnerability of concentration of data, both inside and outside of a country's boundaries, can be a threat to its national security.

Set against these concerns is the fact that international data transmission is already essential for the proper functioning of the world economy and, if permitted, will play an increasingly important role in international cooperation and development in future. Data transmission is now vital to international trade and travel. It can help to provide valuable economic gains both by the international coordination of production, distribution and other activities, and through the sharing of expensive computer and communications resources. Less tangibly, but perhaps most important of all, data transmission is already an important medium of international cooperation and can provide the means for more decentralised decision-making and management in organisations of all kinds. Far from being a sinister force for the increased concentration of power, data transmission can contribute to greater democracy and equality between the nations of the world.

Thus the objective of international policy towards transborder data flows, and data transmission in particular, must be to reap the economic and social benefits as fully as possible while avoiding the dangers. The potential conflicts between national laws on privacy and data security and the freest possible international flow of data need to be resolved. Adequate international data communications facilities at tariffs which fairly reflect their real cost must be assured. And general policies need to be developed which will spread throughout the world the benefits of the tremendous technological advances

achieved by the computer and communications industries. The OECD's concern with these issues is a necessary result of its role in the international community, and together with other international organisations such as the United Nations, the European Economic Community and the Council of Europe it is actively working towards international agreement on the appropriate treatment of transborder data flows.

1.2

The Limitations of Current Knowledge about Data Networks

Any movement towards regulating the international flow of data should have available full knowledge about the value and purpose of existing data networks and the usage made of them. Up to now the information available has largely been confined to the technical side of networks, without much regard to aspects such as actual usage, types of users and applications and reasons for choosing to use an international network. These aspects are fundamental in examining the future role of international data flows and in anticipating the impact of legislation affecting these data flows.

The Organisation for Economic Co-operation and Development (OECD) is well placed for co-ordinating an international investigation into these issues. In August 1977 it commissioned Logica Ltd to carry out this study of the usage of international data networks. Though commissioned by the OECD, the study was actually financed by six of its Member countries France, German F.R., the Netherlands, Norway, Spain and Sweden. In September 1977 the OECD organised a symposium in Vienna to discuss the issues of transborder data flows.

This report sets out the findings of the Logica study. The study has been able to reach some interesting conclusions on the factors influencing the developments of international data networks and will allow the OECD and its Member countries to be much better placed when discussing possible legislation on transborder data flows.

Although small in scale, the study has succeeded in sketching out the broad outlines of international data communications traffic, the reasons for its

appearance and growth, and the issues it raises which may require international co-ordination and agreement. Logica believes that its results will be valuable to the OECD and its member countries in further international discussions.

1.3

The Methodology of the Study

Coverage of Networks

In order to meet the objectives posed by the OECD requirement we decided to investigate a number of international data networks in Western Europe. In addition we felt that the national public data networks already implemented or being implemented would have such a major impact on the future of international data transmission that they should also be included in the study.

We restricted our study of private networks to those including at least one international leased circuit for data transmission. (The terms private and leased circuit are used synonymously.) We did this primarily because it is easier to identify such users and to define the scope and content of their activities; in this way we could utilise the resources available for the study to their fullest extent. Furthermore, there is no reason to believe that leased circuit networks are any different from alternative ways of sending data internationally, except in speed and scale. Finally, leased circuit networks are particularly interesting because they reflect the needs that should eventually be fulfilled by the international public data network(s).

In selecting the private networks to be studied we had to consider several criteria:

- The number of networks had to be large enough to be as representative as possible, but at the same time the number had to be manageable to allow a reasonable coverage of each network within the total resources available to the project.
- The geographical distribution of the selected networks should fairly reflect the relative preponderance of networks in Europe

- The sample should cover all major types of networks e.g.:
 - Private data networks operated by a single multinational organisation
 - Private data networks operated by one organisation for use by many e.g. Computer Service Bureaux
 - Private data networks operated by a closed community of organisations e.g. airlines.

In addition we also decided to cover public data networks both national and international

- The private data networks operated by single multinational organisations should reflect the diverse interests of those organisations e.g. vehicle manufacturers, industrial manufacturers, airlines, oil companies, banks etc.

Initially, therefore, we drew up a long list of all the networks we could identify that had at least one international leased data circuit. This list was drawn up from internal Logica sources, from the wide range of contacts Logica has in Europe and from general searches of conference proceedings and other literature. In all we identified some 60 private networks (including bureaux) that met our requirements. In practice it is likely that our search was not exhaustive and there are probably 100-150 international private data networks in Europe using leased circuits. Given the limited resources of a short study we investigated 24 private networks as well as 6 public data networks. We selected the 24 networks from our complete list to conform as far as possible with the above criteria. Table 1.1 gives the list of the networks investigated (the names of the private network operators have not been included as they agreed to participate in this study on the basis of strict confidentiality - it is fair to say the study could not have been done otherwise). Table 1.2 shows the geographical distribution of private network computer centres - where the network is a data processing network then the host computers have been counted, but where it is a purely data trans-

mission network then the switching computers have been included. Unfortunately one of the organisations did not have a data transmission network and our analyses were limited to 23 networks.

Table 1.1. List of Networks Investigated

<u>Network</u>	<u>Principal Area of Activity of Organisation</u>
A	Industrial Manufacturing
B	Credit Authorisation
C	Consumer Goods
D	Industrial Manufacturing
E	Airline
F	Industrial Group
G	Oil Company
H	Chemicals
I	Clearing Bank
J	Holiday Organisation
K	Manufacturing
L	Oil Company
M	Computer Bureau
N	Computer Bureau
O	Computer Bureau
P	Computer Bureau
Q	Computer Bureau
IIASA	Applied Systems Research
WMO	World Meteorological Forecasting
CERN	High Energy Physics Research
EIN	European Network Research
OIPC--Interpol	Police
SWIFT	Banking Transactions
SITA	Airline Reservations
Nordic Data Network	For Scandinavian PTTs
Transpac	French PTT
EDS	German FR PTT
RETD	Spanish PTT
EPSS	UK PTT
EURONET	EEC/CEPT

Table 1.2. Geographical Distribution of Network
Computer Centres

<u>Country</u>	<u>Number of Centres</u>
UK	13
US	10
German FR	8
France	7
Italy	6
Netherlands	5
Sweden	3
Switzerland	3
Belgium	2
Spain	2
Austria	1
Denmark	1
Rest of the World	11

Notes

1. Only private networks have been included.
2. If the network is a data processing network then the host computers have been counted. If it is a data transmission network then the switching computers have been counted.

Information Gathering

The overall objectives of the study as stated in Sections 1.1 and 1.2, in agreement with the general requirement of the OECD, are very broad and had to be qualified more precisely before the study commenced in order to know what information to collect.

A checklist of information to be collected on each network was drawn up at the start of the study in conjunction with the OECD and the six sponsoring countries. This checklist formed the basis of the study and is included in Appendix B. Briefly it covered the following topics:

- Background to the Organisation's Data Communications Requirements
- Technical Description of Network
- Applications used on the Network and Access Controls imposed
- User Community
- Traffic Types on the Network
- Financial Aspects.

Three approaches were adopted for collecting the information:

1. Literature Research: A great deal of literature was reviewed, drawing on internal Logica sources, libraries, network operators etc to answer as many questions as possible. A bibliography of literature used is shown in Table 1.3. The list does not include papers written on specific private networks because of the confidentiality agreement.
2. Questionnaires were completed by 26 of the network operators. In the other cases either sufficient published information already existed or the operator preferred to answer the questions at an interview. A copy of the questionnaire is enclosed in Appendix B.
3. Interviews were conducted with network operators to supplement the other material.

In all 27 interviews were conducted (5 by telephone). For the other three networks sufficient information had been collected from the literature and questionnaire not to warrant an interview.

Finally a report was written on each network and these are all included in Appendix A. In some cases we have had to omit material from the reports as it would have identified an individual private network. However all the information was used in the overall analysis and to reach important conclusions relevant to the OECD objectives. At the conclusion of the study we decided that the actual checklist was not the most appropriate way of presenting the information on each network. A suitable format for network descriptions was drawn up and is included in Appendix B.

Having collected all the information it was possible to analyse it and address ourselves to the original objectives of the study.

Limitations of the Study

Unfortunately in a study of this nature it is impossible to collect all the desirable information. Though we collected more than enough information to form a very good picture of the usage of international data networks in Europe it was not always possible to collect 'hard data' which would give exact traffic volumes or exact costs.

In many instances organisations were unable or unwilling to release certain detailed information. The particular areas where we did not obtain detailed information are discussed below:

- The number and types of terminals located in each country.
- Contents of data files (or databases) used in international applications. However the organisations gave us detailed descriptions of the applications and the type of data used, if not exact definitions of files.
- Exact volumes of data transmitted by application were rarely available.

- Costs of setting up networks were either not known or difficult to define because of the long evolution periods and overlap with data processing costs.
- Costs of operating a network are very often not divorced from the costs of operating a data processing service. Often the only meaningful figure that can be used in the annual rental for international leased circuits (where the organisations could not supply the costs we used Logica's TARIFICA Service - see Bibliography).

1.4

Acknowledgements

We would like to express our gratitude to the network operators who have given their time and effort to cooperate with us. Their contribution has been invaluable and without it this study could never have been completed.

In addition we would like to thank the OECD and the member countries who financed the investigation (France, German F.R., the Netherlands, Norway, Spain and Sweden) for giving us the opportunity to undertake this very interesting project.

Table 1.3. Bibliography on Networks

Reports

1. European Informatics Network; Cost-11 Progress Report (London) Sept 1975.
2. World Weather Watch - Seventh Status Report on Implementation (WMO - Geneva).
3. TARIFICA - Telecommunications Services and Tariffs in Western Europe (Logica - London) 1977
4. Public Data Networks: Plans of the European Telecommunications Administrations (CEPT-Darmstadt) 1977.
5. Packet Switching Services and the Data Communications User (Ovum Ltd - London) 1976.
6. Les Flux des Données Transfrontières dans le contexte de la Co-opération Policière Internationale (O.I.P.C) - Report sent to the OECD, 1977.

Conference Papers

7. ICCS Proceedings (Toronto) 1977.
8. Papers presented at the ON-LINE Conference on Data Communications Networks (London) May 1977.
9. Informatique Distribuée - Convention Informatique (SICOB - Paris) 1975.

PTT Publications

10. P.O.E.E.J (U.K. Post Office Journal).
11. P.O. Telecommunications Journal.
12. TELE (Swedish Telecommunications Administration) - Special Reprint on the Nordic Data Network 1976.
13. TRANSPAC (French PTT) 1977.

14. Planungshilfe für die Datenfernverarbeitung (Die Deutsche Bundespost Informiert) 1977.
15. EURONET - Guidelines for Co-operation between data base suppliers and host organizations (Commission for the European Community - Luxembourg) June 1977.

Journals

16. Euronet News (Commission for the European Community - Luxembourg).
17. Computing (Haymarket Publications - London).
18. Computer Weekly (IPC - London).
19. O-1 Informatique (Editions Tests - Paris).
20. Die Computer Zeitung (Konradin Verlag-Leidenfelden - Echterdingen, GFR).
21. Datamation (USA).

Miscellaneous

22. Unlabelled published articles on RETD.
23. Internal Logica Reports.
24. Organisation descriptions of their networks/facilities.

2. SUMMARY OF THE LOGICA STUDY

2.1 Introduction

The study investigated 24 international private data networks including:

- 12 private, single - use, networks
- 7 community, multiple-use, networks
- 5 computer bureau networks
- and
- 6 public data networks.

(A list of the networks is given in section 1.3).

In fact one of the private single-use networks was not used for data transmission and our analyses were limited to 23 international private data networks.

The research and analysis were directed towards answering five distinct questions so as to be able to assess the factors which will influence future development. The five questions were:

- 1) Why do organisations use international data communications?
- 2) What has been the technical development of networks?
- 3) Which applications make use of international data networks?
- 4) What access control and security measures are adopted by the network operators?
- 5) What are the costs and economics of operating international data networks?

2.2 The Reasons for International Data Communications

The reasons organisations use data communications fall into two areas, the benefits to be achieved by communications and the specific advantages of data transmission.

There are four main reasons why organisations are making use of international data communications:

a) Indirect Financial Benefits

Multinational organisations can achieve indirect benefits from communications by co-ordinating their production, marketing and financial management.

b) Direct Financial Benefits

Direct financial benefits can be achieved within an international organisation by sharing data processing resources and expensive telephone circuits.

c) Inherently International Activities

These activities, by their nature, can only exist if there is international communication e.g. international banking and credit, airline and other reservations, world meteorological co-operation.

Some of these activities can only exist with fast, accurate communications, others would simply be more expensive if data communications were not available.

d) International Co-operation

The pooling of international resources and ideas for scientific and technical research or police activities are examples of the need for international communication for the furtherance of international co-operation.

International relations is often an important factor for multinational companies when choosing the location of a new office or factory. In such cases data communications requirements are created when a different location would have avoided the need.

For all the four reasons above, international data communication of one form or another is essential. The choice of data transmission is made because of one or more of the following factors:

- large volumes of data need to be transmitted; voice communication is obviously unsuitable and postal communication can be too slow or too expensive.
- the data to be transmitted is to be stored and or processed by a distant computer and so should be in a form which will allow it to be entered directly into the computer. Data transmission over private networks offers the user a fast and simple answer.
- There is a need for accurate transmission, for example, in bank transactions, and the standard transaction format possible in data communications means that a validation of the data can be performed before transmission. This has already resulted in considerable time savings in banks.
- High security measures are required in applications such as banking or police work, and encrypted data transmission on a tightly controlled network can provide better security of information exchange than any other public facility available. Furthermore it is possible to have message authentication, as used on the SWIFT network, thereby reducing the risks of fraud.
- Finally, if an organisation is sharing a central data processing resource between an international community then clearly some form of data communications is required.

The networks covered during this study made use of data communications for a combination of the above reasons. For example a reservations system requires fast, accurate transmission of data to be processed by a central computer, or the World Meteorological Organisation (WMO) requires to pass large volumes of data between Weather Centres, etc.

2.3

Technical Developments of Data Networks

All of the networks studied used international private leased circuits, with the obvious exception of the public networks. Some did use dial-up connections on the PSTN (Public Switched Telephone Network), but they were still based on leased circuits.

Though private circuits are expensive relative to the PSTN, are inflexible to change without long delays and are not permitted to carry third party traffic they are still preferred to the PSTN! The reasons are that the PSTN is unsuitable for high speed data traffic, the quality is not very good, the time to set up a call is very long and security and control are not good enough for many organisations.

Having therefore chosen to use private circuits, network operators, or other interested parties, have developed techniques for using the circuit more efficiently and thereby bringing the usage costs down. These developments led to private networks operated and used solely by one company. The developments include the use of concentrators and multiplexors, and more recently the implementation of private switched networks.

Computer Bureaux initially began offering remote access via dial-up lines using the PSTN. However, wishing to capture a larger market they began leasing private circuits with dial-up concentrators so that distant users would only need to make a local call to access the bureau.

A parallel development in networks arose when a community of organisations with very closely allied interests - the airlines - wished to develop a shared or community network. The attraction of the concept was that, individually, the airlines could not afford a world wide, high speed, high quality leased circuit network. Together they could, but they would run into the problem of third party traffic. However, since the PTTs could not offer a suitable alternative, the SITA network was allowed to develop and the SWIFT banking network has since followed. However, the networks are very carefully controlled by the PTTs i.e. they can only carry traffic related to its original use, and they are having to pay a higher tariff than the single use private circuits. The community networks, SWIFT in particular, are now being faced with a new method of tariffication based on the volume of data transmitted. In principle this scheme should not necessarily be unfavourable, and as will be discussed later may well be the natural method of charging for the new public data networks. However the proposed charging structure for SWIFT states that though SWIFT should pay for the volume of data transmitted, there should be a minimum payment equivalent to the

current tariffs for the private circuits used by SWIFT, i.e. either they pay the same or more.

Finally, the progress has come full circle with the development of Public Switched Data Networks (PSDN). The networks, either developed or being developed, are fully switched, and will allow high speed data transmission with good quality circuits, short call set-up times and high security control measures. The networks will be dominated by a usage charge, either time sensitive or volume sensitive. The initial reaction to volume sensitive tariffs has not been welcoming, though this must partly be due to the SWIFT discussions.

The initial tariffs proposed by France and Sweden are not very expensive although they favour the low speed, low volume user. However, ultimately their acceptance will depend on the actual tariffs levied.

Finally, one great advantage the PSDNs will offer will be the ability to interconnect equipment of different makes provided they work to CCITT international standards.

The final level of development will be the interconnection of the PSDNs. In Europe the most important development in this area is EURONET. Developed initially by the nine EEC partners as a network for accessing European databases, and due to start in 1978, it is likely that in the future it will be used as the basis of a European public data network.

2.4

The Applications Using International Data Communication

In studying 30 international data communications networks, a great many applications were identified. However these applications can be categorised into eight application types and it is possible to discuss each type and establish why these applications are used internationally, particularly with reference to the discussion in section 2.2.

Production and Distribution

A multinational organisation can achieve considerable

benefits by co-ordinating its international manufacturing and marketing activities. In order to achieve this, information about production capabilities and sales activities need to be processed centrally and so produce optimal manufacturing and distribution scheduling. Hence this is a case where data needs to be transmitted to a central computer for processing and the results transmitted back to the outstations.

Financial Management

As with manufacturing co-ordination, financial co-ordination within multinational organisations is seen as an essential activity, not only from the point of view of maximising their use of funds but also for accounting purposes. These types of applications normally require a central computer facility and accurate data transmission.

Personnel and Payroll

Personnel applications have already caused a great deal of discussion, related to privacy legislation. Although a certain amount of international transmission of data related to such applications such applications was identified during the study, it was found to be a minor application. Where it was used, the reason was because of shared data processing facilities. In the main, international organisations appear to prefer to handle the personnel and payroll applications locally, probably to avoid any legislative problems but also because it is now such a standard computer application that it can easily be handled anywhere.

Banking and Credit Control

International banking and credit activities are a direct result of growing international trade and travel. The information that the organisations deal with is sensitive - personal or company bank accounts or credit ratings. As a result there is a need for very accurate and secure data transmission and often, particularly in the case of credit authorisation, high speed transmission. However, it is important to state (as will be done on several occasions during this report) that these organisations go to great lengths to keep their information secure.

Reservations

Reservations systems are inherently international activities. The possibilities of fast and accurate data transmission have resulted in on-line systems which utilize the available resources much better and give the end customer a much improved service. This activity is already one of the most used international applications and will almost certainly continue to grow. However, it also deals with personally identifiable data - the customer reservation records.

Government and Public Authorities

Public bodies often use computer bureaux for their statistical work and simulation modelling. The reason the data is subject to international communication is because the public body will choose the bureau offering the most attractive mix of cost and facilities. However, it was not possible to establish in detail the data used for the different applications because the computer bureaux, firstly, have to respect their clients confidentiality, and, secondly, often do not know what use is being made of their timesharing facilities.

One exception to Public Authority international data transmission is OIPC-Interpol. Interpol are deliberately involved in transmitting personal data across national frontiers, as part of the international co-operation of police activities.

Scientific & Technical Research

Research activities are being undertaken more and more on a basis of international co-operation. Not only do the members of the community find the exchange of ideas and information stimulating but in cases like high energy physics research, the massive expenditure required for experimentation can only be funded jointly e.g. CERN laboratories. Such co-operation produces a need for data communications to access shared data or to access remote computer centres while working at CERN.

Environmental Monitoring

The World Weather Watch application co-ordinated by the World Meteorological Organisation (WMO) is the best known of environmental monitoring applications. In order to forecast weather conditions in a particular location it is necessary to know the weather in a large area surrounding the location. It therefore follows that international co-operation is required and large volumes of data are passed between the co-operating meteorological centres and processed to forecast world weather conditions. Not only is this of great value on a day to day basis as a navigational aid etc, but can be used to minimise the effects of natural disasters such as hurricanes and floods. Other environmental monitoring applications may well grow to international levels with the development of international data communications.

2.5

Access Control and Security

Undoubtedly network operators have put a great deal of thought into the security of access both to the networks and to applications. The level of security varies considerably over the networks, but the level was always suitable to the applications. For example, the access control to an application dealing with order entry of spare parts for cars was not considerable, whereas, access control to an airline reservation system involved 100 different levels of authority for access, ability to update information, etc. In general commercial confidentiality was taken very seriously by operators. Hence financial information, whether about private companies or in banking systems always resulted in strong access control.

The most impressive security measures were found in the SWIFT network, including terminal identification, authorisation codes, message sequence numbers, data encryption, authentication codes etc. Bureaux also showed a high level of security, both to protect themselves and also to attract security minded

customers.

Finally, the new public data networks will be offering additional access control methods in their attempts to create a true alternative to private leased line networks.

2.6

Cost and Economics of International Private networks

The annual circuit rentals for the networks in the study varied considerably, from \$40,000 to \$20 million. However a large proportion had costs between \$100,000 and \$500,000. The real cost of operating a private network, which includes equipment and personnel costs, is generally about twice the line rentals, though it can be as high as five times in a complex network.

The cost of transmitting data is difficult to calculate without detailed operating costs which we were unable to obtain. However, considering just the line rentals, the cost of transmitting 1000 characters varied between 1 and 10 US cents for the majority of the networks. This compares with the proposed tariffs for the public data networks which will be about 1 US cent for 1000 characters.

The sensitivity of the networks to increased data transmission costs depends very much on the nature of the organisation. Reservations systems dealing in high value transactions would not be greatly affected if transmission costs increased, whereas a bank, whose commission per transaction is relatively small, would probably not tolerate a large increase. Industrial companies which use data transmission as a means of improved efficiency would be unlikely to suffer from increased costs if their turnover is high - the companies in the survey have turnovers of several million US Dollars - but increased transmission costs would discourage the development of such applications, particular by smaller organisations. Finally, computer bureaux are likely to be highly sensitive to increased transmission costs. When a bureau introduces a line to another country then the cost of the line has to be absorbed

by the extra revenue earned in that country. If the line cost goes up then additional revenue is required if that part of their operation is to remain profitable.

3. IMPLICATIONS OF THE STUDY RESULTS

3.1 Introduction

International data communications are already producing substantial benefit for large international companies, including air lines and banks, either through more efficient management, or by computer resource sharing. Furthermore, and by no means less important, it has facilitated international co-operation in areas such as scientific research and weather forecasting. However, the emergence of international data transmission has intensified fears about the possible infringement of personal privacy, the dangers of increased international interdependence and potential threats to national sovereignty. This chapter is concerned with the findings of the study in relation to these concerns, and their implications. In addition it discusses the impact of tariff levels and service availability on the future of international data transmission.

3.2 Privacy of Transborder Data

The national privacy laws which have already been enacted or are currently under discussion are mainly concerned with the privacy of personal data. The OECD and other international bodies are now working towards a harmonisation of the various national laws in order to reduce legal anomalies which may unnecessarily hamper transborder flows of personal data. However, we identified only a few instances of such data flows except in banking, credit control or travel applications. The few instances of personnel type applications which we identified were operated internationally for reasons of computer resource sharing, so that the data is accessed only from the country of origin.

The large volumes of personally identifiable transborder data flows resulting from banking, credit control and travel applications have already become an integral part of international trade and travel and will continue to become more important as the demand for the services offered continues to

grow. An important conclusion of the study is that while data transmission has greatly facilitated the growth of these applications, it has at the same time made possible greatly increased security for information that would in any case be transported internationally. This is exemplified by the very sophisticated security procedures at SWIFT and the decentralisation of personal credit files that has been achieved on the credit control network included in the study.

Though personal privacy has been widely discussed over the last few years, we found that a great deal more transborder traffic relates to sensitive corporate information. Several of the multinational manufacturing companies in the study were found to hold marketing files which included client or customer details. These files often contain considerable information about each client's activities, background, annual product requirement, credit rating, etc. Although the client file is held for specific marketing or sales reasons, the information would be of great commercial value to other organisations, and the companies referred to would not in general wish it to be freely available. As we have already said, the networks we investigated showed a higher level of security than would have been possible without data transmission and data processing. However, no amount of technology can provide total security against misuse of information. We believe that the protection of non-personal data should be included as part of any discussions on an international data policy.

An interesting point that came out of discussions with network operators was the general level of ignorance relating to impending privacy legislation. In those countries where legislation has not been enacted the operators knew little about the likely content of the privacy laws. However, because the study concentrated on international applications, most operators were not unduly concerned since few applications involved personal details. It was also apparent that operators considered the impact of legislation, on a national or international level, would not be great because of the high levels of security already adopted. The greater burden would be in procedures needed to meet the administrative requirements of legislation. The operators who showed the greatest concern were computer bureaux. Confirming statements made at the Vienna Symposium

(September 1977) the bureaux felt that they should not be made responsible for the applications their customers use - it would create too great a burden upon them to monitor the applications for compliance with legislation.

3.3

Interdependence Resulting from International Data Flows

This study has undoubtedly confirmed that international data transmission does lead to national interdependence. The advantages of using remote data processing facilities for sharing expensive facilities have led to situations where users in one country become dependent on the reliable operations of facilities in another. Several examples of such interdependence were identified in the study. Several national airlines use seat reservation systems belonging to and located in a foreign country (eg AIR IRAN uses the KLM computer in Amsterdam); the world banking community will become increasingly dependent on the reliable operation of the SWIFT switching centres in Belgium and the Netherlands; the World Weather Watch network is dependent on the operation of the national centres on the main trunk ring, particularly the UK centre. Customers of time-sharing bureaux are often using computers in foreign countries (sometimes unknown to the user); and finally all the multinational companies are dependent on both the network centres and the computer centres operating reliably.

However, with the advent of switched and distributed networks, technology is creating means of reducing the risks of interdependence. SWIFT, for example has its two switching centres located in different countries; if one centre fails then the other can handle the complete network; similarly SITA's packet switching network allows switching centres to fail without causing much disruption to the majority of users. Timesharing bureaux often operate several computer centres located in different countries; if one machine fails the customers using it can be automatically transferred to another centre, although the general level of service declines.

The implication is clearly that although data transmission will inevitably lead to interdependence, the risks can be reduced by use of switched or distributed networks. However these networks incur high costs of transmission circuits and would normally require further justification. If, on the other hand, public switched networks or international circuit tariffs are attractively priced then such networks could be implemented more often. Inevitably there will always be some level of interdependence. The resulting dangers could be reduced by International Agreement on the freedom of international data flows from local intervention.

3.4

National Sovereignty

Fears have been expressed that as national interdependence increases the activity of a country to control its own affairs will be reduced, thereby infringing on its sovereignty. Certainly the increasing influence of multinational companies in the trade and industry of many different countries has resulted in data relevant to the day to day functioning of a country being held outside its borders. If that data is withheld for hostile or other reasons then the industry of a country may be put at risk. Furthermore, if the multinationals hold vital data relating to the operations of the company in distant computers then the ability of a Government to direct the operations of that multinational in its area of authority is reduced.

3.5

The Impact of Data Transmission Tariffs and Public Data Networks

International data transmission has already become very important if not essential to large organisations. However, this is only a recent development, and its full potential has yet to be realised. At present the high costs involved ensure that only large organisations can afford to operate international data networks. Few international leased circuits cost less than \$20,000 per year. International telex rates are also so high as to inhibit usage - the cost of transmitting 1000 characters internationally on the telex networks is about 60 US cents, whereas the private networks have

achieved costs of 1-10 cents. The PSTN (Public Switched Telephone Network) could be an alternative but often it is technically inadequate and also expensive because of the low transmission speeds.

However there is a large number of medium and small companies that need data transmission facilities and could use these facilities to achieve benefits, to realise a higher level of data security and to reduce their vulnerability to international interdependence, but cannot justify the costs.

In order to meet the demand of these organisations it is essential that PTTs begin offering data transmission facilities at economically attractive rates. The present indications are that the new public data networks will offer attractive rates - the proposed rates for intra-national traffic suggest the cost of transmitting 1000 characters will be about 1 cent. The rates will be usage dependent which will obviously attract the smaller organisations.

On the other hand, the new public networks will raise other issues. A large investment is being made on the part of the PTTs and it will be tempting for them to recuperate their investment as fast as possible by discouraging the use of private circuits and transferring the users to the public networks. This discouragement could occur by increasing the private circuit rentals or even by withdrawing private circuit facilities altogether. Yet it is the organisations that are using private networks who paved the way for public networks and it would be a great injustice if their past and present investment suddenly had to be written off, particularly since a truly international public data network will not be available for several years yet and companies are having to continue implementing new private networks to meet their present requirements.

CONCLUSIONS

1. The use of international data transmission has produced substantial financial benefits to large multinational companies, airlines and banks.
2. The benefits have been achieved by using company resources more efficiently. Efficient use of resources has been made possible by sophisticated data communications networks.
3. Computer resource sharing is one of the reasons for the initial development of networks and is still one of the most important reasons for data transmission on both a national and international scale.
4. Many of the companies who have taken advantage of the benefits of international data transmission have radically changed their operations, so much that they are dependent on the continued reliability of the service e.g. the world's airlines.
5. The development of international private (leased circuit) networks is a very recent phenomenon and as yet its full potential has not been realised.
6. International co-operation in scientific research and other areas will be stimulated by the development of international data transmission facilities. This has already been demonstrated by the World Weather Watch and European co-operation in high energy physics at CERN.
7. The technological advances of data processing and transmission have created much higher standards of security in information processing than was previously possible. The security of the SWIFT network and the credit control network in this study are much higher than was possible in these applications prior to the implementations of the networks.

8. The more recent development of private switched networks and distributed processing has resulted in much greater reliability of operation and reduced the dependence on individual installations.
9. International data processing and transmission has created a situation of international interdependence, however switched networks are at the same time reducing the attendant risks.
10. However, there will always be some level of international interdependence resulting from international data processing and transmission, and only an international agreement ensuring the free flow of international data can entirely remove the dangers.
11. The most widely used applications over international networks are those relating to company management (i.e. production and stock control, financial planning etc.), banking, credit control and travel reservations.
12. As part of co-ordinated production and stock control applications, some multinational companies hold centralised data files for all their operating companies. This means that data relating to the day to day running of a country's industry is held outside its borders.
13. Most of the personal data transmitted internationally relates to banking, credit control and travel reservations. The level of security has always been high and has become higher with advanced data transmission techniques.
14. Sensitive corporate data is also subject to international transmission. It is often in the form of marketing or sales information held by manufacturing companies about their clients. This data is as sensitive as personal data and should be granted the same protection.

15. The cost of international leased circuit networks is very high, the simplest one-line network would cost about \$20,000 per year and most networks in this study cost at least ten times as much.
16. As a result only large organisations can take advantage of the benefits offered by private leased circuit networks.
17. Many organisations such as airlines or large multinational manufacturing companies would not be very sensitive to a substantial increase in the cost of data transmission because these costs are a small part of their overall costs and the benefits achieved are large in comparison.
18. However, other present day users would be sensitive to minor increases in cost, for example banks, whose charge for handling a single transaction is quite small, or computer bureaux who have to equate the circuit costs with the extra business the circuit brings.
19. Increased data transmission costs would also slow down the development of those smaller companies now beginning to use the facilities.
20. Even without increased costs the majority of organisations requiring international private circuit facilities cannot justify the cost. The alternatives to leased circuits, telex or the public switched telephone network (PSTN), are often unsuitable.
21. International telex usage is very expensive compared with bulk data transmission over leased circuits. The organisations in this study are achieving costs of 1 to 10 US cents per 1,000 characters transmitted internationally; within Europe the equivalent telex cost is 60 cents, and to the US much more.
22. The PSTN facilities are poor for data transmission (the error rate is high, the call set-up time is long and it is not sufficiently reliable) and because attainable data transmission rates are low it can also prove expensive.

23. The public switched data networks being implemented should overcome the shortcomings of both the PSTN and leased circuit networks and meet the requirements of all organisations.
24. It is essential that the international tariffs for using these networks should be attractive to allow medium and small organisations to take advantage of all the benefits data transmission offers over other means of international data transportation. The proposed national tariffs indicate a usage charge of about 1 cent per 1,000 characters transmitted.
25. It is unlikely that a European-wide public data network will be available for at least five years.
26. Since organisations have an immediate need for European-wide networks, more private networks will be implemented in the next few years. Organisations also have a pressing need for detailed information on when a European public network will be available.
27. The PTT administrations should therefore continue to offer private circuits at the normal tariffs for several years after the implementation of public networks to enable those organisations to make a gradual and inexpensive transition.

PART 2

5. THE REASONS FOR USING INTERNATIONAL NETWORKS

5.1 Introduction

A large number of international organisations and communities are now dependent on international data communications. Some organisations demanded, and pioneered improved means of communications, others have made use of the facilities and technology which became available. In studying 23 international networks (i.e. excluding the public networks) we were able to establish the most important reasons why the operating organisations use data transmission as their means of communications.

5.2 The Reasons for International Data Communications

Four prime reasons stand out as creating a requirement for international communication:

- a) Indirect Financial Benefits
- b) Direct Financial Benefits
- c) Inherently International Activities
- d) International Co-operation.

a) Indirect Financial Benefits

Multinational organisations operating in the industrial and commercial sectors have achieved substantial financial savings by co-ordinating their world-wide production and marketing activities. The companies have been able to reduce their production costs by having specialised production facilities and a well co-ordinated marketing and distribution organisation.

Furthermore, centralised control of financial and management activities has also produced financial benefits to the multinationals. Clearly these activities require international communications between the different parts of the organisation.

b) Direct Financial Benefits

Once an organisation has committed itself to using data processing, and there can be hardly any large organisations which have not, then financial benefits can be achieved by sharing the computer facilities throughout the organisation. Clearly, with an international organisation, this requires international communications.

Computer bureaux are a clear example of resource sharing, though not within one organisation. Bureaux have implemented international private circuits from their DP centres to other countries so as to attract new customers.

Communities of organisations with close relationships, such as airlines and banks, have achieved direct financial benefits by sharing the communications network rather than their data processing facilities. The airlines, for example, all have some form of seat reservation. Those with a computer reservation system would ideally like to have a world wide network. No single airline can justify such an expense but because the requirements of the airlines are very similar, they have been able to share a network - SITA.

c) Inherently International Activities

With the increase of international trade and travel, activities such as banking, credit authorisation and travel reservations have become more international in their operations and require some efficient means of international communications. Eight of the organisations interviewed in this study were of this type.

d) International Co-operation

International Co-operation in many fields of activity has made use of communications facilities and in many cases has been stimulated by the availability of such facilities. Several examples of such co-operation were identified during the study.

For example, co-operation for scientific and technical research as with CERN and EIR, police co-operation under the auspices of OIPC-Interpol, and international environmental monitoring, notably the World Weather Watch operated by the World Meteorological Organisation.

In addition international companies are conscious of international relations when locating offices or plants. Such considerations can lead to a data transmission requirement which might otherwise have not been needed. For example, one organisation in our survey has several manufacturing companies located in different countries; the companies jointly set up a Production and Distribution Control Office. The Office is located in a 'neutral' country though it requires access to the Head Office Computer Centre - hence the international data transmissions results from a deliberate "international relations" decision.

Clearly most organisations require communications for a combination of the four reasons, the table below shows how many organisations, in the study, thought which reasons contributed to their requirement.

<u>Reason</u>	<u>Number of Organisations</u>
Indirect Financial Benefits	9
Direct Financial Benefits	15
Inherently International Activities	8
International Co-operation	5

5.3

The Reasons for Using Data Transmission

Having established a requirement for international communications, why do the organisations studied choose data transmission as their means of communications? Clearly the major reason is the increasing use made of data processing; and therefore data transmission is the obvious means of communication with and between computers. However, six distinct factors were established which made data transmission essential rather than desirable. Not all of the factors were relevant to all of the organisations.

a) Large Volumes of Data

3 organisations needed to transmit large volumes of data between relatively few points. In such cases data transmission over private leased circuits is economical, simple and fast. The alternatives i.e. the public telephone network, air freight or post are impractical or too slow.

b) Data Which Needs to be Processed

The data being transmitted needs to be stored or processed at the distant end, so it should be in a form which will allow direct entry into the computer. Though the data could be sent by air freight or post on magnetic tapes the delay would be unacceptable.

c) Fast Access to Information

Users need to access or update information held at a distant computer and need to access it quickly. Data base retrieval systems now available make this possible using data transmission. Examples in this study were various reservations systems, stock enquiry and orders and credit authorisation.

d) Resource Sharing

Data transmission is obviously necessary for remote access to data processing facilities.

e) Validation of Data to be Transmitted

There is a need for accurate transfer of data, for example, in bank transactions and credit authorisation. In banking, particularly, errors used to arise because messages were ambiguous, correspondents were working in a foreign language etc. Data transmission has allowed the use of fixed format transactions which can allow validation of data before transmission and thereby can save a great deal of time and effort.

f) Security of Data

Tight security measures are required in applications such as banking, credit control and others concerned with confidential data. Data transmission can offer high levels of security, such as access control, data encryption and message authentication.

Table 5.1 below shows how many organisations thought each of the factors to be an essential reason for data transmission.

Table 5.1. Reasons for Organisations using Data Transmission

<u>Factor</u>	<u>Number of Organisations</u>
Large Volumes of Data	3
Data which needs to be processed	15
Fast Access to Information	10
Resource Sharing	15
Validation of Data	5
Security of Data	7

Table 5.2 shows the number of organisations using their networks for particular types of traffic.

Table 5.2. Data Traffic Types transmitted over Networks

<u>Traffic Types</u>	<u>Number of Organisations</u>
Interactive	14
Message Switching	6
Bulk Data Transfer	2
Remote Batch	10

6. TECHNOLOGICAL DEVELOPMENT OF NETWORKS

6.1 PTT telecommunication facilities

The user of data communications may require some or all of the following features in a telecommunication facility.

1. Relatively inexpensive
2. Switching facilities
3. No restrictions on traffic
4. Good quality for data transmission
5. High transmission speeds (4800 and 9600 bps)
6. Short call set-up times
7. High level of security.

At present (in most countries at least) his choice is restricted to either the Public Switched Telephone Network or private leased circuits. Table 6.1 shows how the two facilities compare with each other with regard to the above factors:

Table 6.1. Comparison of Facilities and PSTN and Private Circuits

	<u>Facility</u>	<u>PSTN</u>	<u>Private Circuits</u>
1.	Relatively Inexpensive	Yes	No
2.	Switching Facilities	Yes	No
3.	No Restrictions on traffic	Yes	No
4.	Good quality for Data		
	Transmissions	No	Yes
5.	High Speeds	No	Yes
6.	Short Call set-up	No	Yes
7.	High level of security	No	Yes

The restriction on traffic (3) refers to the European PTT regulations which do not allow third party traffic on private leased circuits.

6.2 The Development of Private Networks

The majority of large organisations have chosen to use private leased circuits as well as the PSTN. (All the networks in our sample were chosen on the basis that they did use private circuits, 12 of the 23 private networks also used the PSTN.) The reasons

have been a combination of the advantages outlined above which, in their opinion outweigh the advantages of the PSTN. Furthermore, it has been easier to develop techniques to overcome the problems of using private circuits than to overcome the deficiencies of the PSTN.

Cost

The cost of international private circuits is generally considered to be high - it is equivalent to several hours per working day of international PSTN costs. It is difficult if not impossible to justify such a circuit for voice use only. However two approaches have been adopted to use the circuits more efficiently and thereby justify the costs:

1. Use of alternate voice and data (AVD) (including telex). In these cases the operators will use the circuit for speech several hours per day and data transmission for several hours. However this use is decreasing and only 4 of the 23 networks incorporated it.
2. High data transmission speeds (4800 and 9600 bps). Data transmission on the PSTN is really only possible at speeds up to 2400 bps and so the private circuits can be used two to four times more intensively. High speed transmission on the lines is used either for high speed terminal or computer communication, or by concentrating the data from several slow speed terminals into one high speed line. 17 of the 23 networks in the study used some form of concentrators or multiplexors.

Table 6.2 below shows the number of organisations using private circuits at particular transmission rates - An organisation using, say, 2400 bps and 4800 bps will be counted twice.

Table 6.2. Speeds of Circuits used by Organisations
in the Study

<u>Data Transmission Rate (bps)</u>	<u>Number of Organisations</u>
1200	4
2400	6
4800	12
7200	2
9600	9

The table shows clearly that the organisations surveyed are using high speeds of data transmission on international circuits.

Switching Facility

The ability to switch circuits or packets of data serves two purposes. Firstly it gives a user more flexibility in accessing different computers, and secondly, the circuits are used more efficiently because users can share them. Sophisticated packet or message switching techniques have been developed for private networks. Of the 23 networks surveyed 10 are already using some form of switching facility; several of the operators are also planning more sophisticated packet switched networks to be implemented during the next two or three years.

Restrictions on Traffic

In Europe there is a legal restriction on the use of private circuits which prohibits the carriage of third party traffic. This, in effect, means that a private network cannot be used for the through transmission of data between two users neither of which is the network operator. Three types of situations that can lead to third party traffic were identified in the study:

- Firstly, bureau networks should not be used as data or message switching networks, but as access networks to the bureau's data processing centres. However, often the distinction becomes blurred. For example one organisation in the study collected information within Europe and put it onto a file at a timesharing bureau. The organisation's head office in the USA then

accessed the same bureau to read the data.

- Secondly, Community networks such as SITA and SWIFT. The networks are used deliberately as transmission networks connecting various members of the community. In these cases the PTTs agreed to allow the networks to operate because no alternative facility could be provided. However, the operators have had to pay a higher tariff and they are restricted in the traffic which may be transmitted - SITA can only be used for Airline Seat Reservations.
- Finally, the EEC were initially proposing to develop EURONET as a private network for database access within the EEC. Private databases would be connected to the network and would be available to EURONET subscribers (this is very much the way in which Tymnet works in the USA). However because of the third party limitation this was not possible and was overcome by the EEC financing the PTTs to develop EURONET and allowing them to use spare network capacity for the development of public data networks.

Chronological Development of Private Networks

To exemplify the fast and changing development of data networks Table 6.3 shows the number of network from the sample which began operating each year in the last nine years (all of the networks were developed in or after 1969).

Table 6.3. The Number of Networks in the Survey
Implemented by Year

Year:	69	70	71	72	73	74	75	76	77
Number:	1	3	1	4	0	2	1	4	3

Seven of the 19 networks for which we had relevant information were implemented in the last two years. In addition several of the network operators were currently involved in plans for improving their networks to make use of the latest technology.

The Development of Public Switched Data Networks

The PTT administrations are now taking advantage of the technological developments to design and implement public switched data networks using either circuit switching or packet switching technology. The networks will offer the users:

- Switching Facilities
- No restrictions on traffic
- Good quality data transmission
- High speeds
- Short call set-up times
- High level of security.

At this time it is not possible to comment on the relative cost of the PSDNs because little tariff information is available (see section 9).

The PSDNs will be using CCITT standard protocols which will allow users to interconnect equipment of different makes provided that manufacturers provide equipment working to these standards. For example the French public network TRANSPAC and probably all other permanent public packet switching networks will be using CCITT recommendation X25. So far only IBM, among the manufacturers, have announced that they will support X25 on TRANSPAC, although their supports will only be for IBM terminals accessing IBM computers via their own SNA (Systems Network Architecture) concept. However, it seems likely that some equipment manufacturers and software companies will develop interfaces for X25 connection of most equipment.

Table 6.4 shows the current development of European PSDNs.

In addition the EEC partners are now in the process of developing a joint international packet switching network - EURONET. Initially the network is being developed for accessing European databases from anywhere within the EEC. However the contract with the PTTs allows them to use any spare capacity within the network for the development of public data networks. This has resulted in most of the administrations studying the feasibility of connecting their own PSDN to Euronet in order to achieve a European wide PSDN.

Table 6.4. Development of European Public Data Networks

Country	Proposed Network	Switching Type	Proposed Date of Operation	Comment
Belgium	-	Packet	1979	In study stage. probably experimental
Denmark	Nordic Net	Circuit	1978	Joint Net. Hope to have Packet Switch Connection
Finland	Nordic Net	Circuit	1979	Joint Net. Hope to have Packet Switch Connection
France	TRANSPAC	Packet	1978	
German FR	EDS	Circuit	1977	Hope to have Packet Switched Connection
Italy	-	Circuit (based on telex)	1978	Packet Switched Net in 1980
Netherlands	-	Packet	1979	
Norway	Nordic Net	Circuit	1979	Joint Net. Hope to have Packet Switched Connection
Spain	RETD	Packet	Available	
Sweden	Nordic Net	Circuit	1978	Joint Net. Hope to have Packet Switched Connection
Switzerland	EDW	Circuit	1978	Hope to develop Packet Switched Network based on Euronet
UK	EPSS	Packet	Available	Will probably develop new X25 Packet Switched Network by 1979

However several of the private network operators interviewed pointed out that in the last few years they have invested large amounts of time and money into developing their own networks and are planning to continue doing this because the public networks will not be ready soon enough. Several operators were very interested in planning for the time when international public data networks would be available, but felt that insufficient detail was currently available.

7.1

Introduction

The type and content of international data traffic can be derived by analysing the international data processing applications that give rise to this traffic. The type and geographical spread of users of particular applications reveals reasons for setting up and using international data networks and indicates the degree to which operators have become dependent on international data communications to continue to carry out their specific activities.

In an analysis of international data traffic carried by the networks researched, we have therefore considered three relevant aspects.

- (1) the types of applications supported by the host computers and accessed by international locations. Although specific applications vary according to the activities pursued by the network operators many cut across these activities and have therefore been classified as follows:

Types of Applications

- 1 Production and Distribution
 - 2 Financial and Management
 - 3 Personnel and Payroll
 - 4 Banking and Credit Control
 - 5 Travel Reservations
 - 6 Government and Public Authorities
 - 7 Scientific and Technical Research
 - 8 Environmental and Geographical Monitoring.
- (2) the location of host computers in Europe or the USA, accessed by European locations;
 - (3) the location of access points in Europe or the USA to the host computers, i.e. the locations between which data traffic takes place.

The international usage of each application will be discussed in the following section, giving examples and indicating the countries between which these

applications give rise to data traffic. The networks investigated are representative examples of other organisations carrying out similar activities in other countries with consequently similar applications. For example 'Stock Control' is an application likely to be used by most manufacturers, and 'Foreign Exchange' will be used by any international bank.

Whenever we come across what might be considered 'sensitive' data being sent internationally, we have enquired about the information held on the corresponding data files, and details are given in the section where a particular application type is discussed.

Applications refer either to objects, people or organisations and a network operator may be transmitting or processing his own data or data referring to or supplied by other organisations, people or objects.

In our study this can be exemplified in table 7.1 below where the different types of applications encountered are shown according to the origin of the data (own/other) and its content (referring to objects/peoples/organisations). Table 7.2 shows the number of organisations processing their own or other peoples data.

Of the 22 international network operators for whom this could be applicable, 15 transmit data with personal content. With some, like airlines or banks, the proportion of such data is very large to the extent that their operations are unthinkable without it; for other organisations the processing of personal data forms only a small part of their business; for example a timesharing bureau offering a Payroll Application.

Five of the 22 networks - all of them private - also use their network for non-data communication (voice/telex). Where such an integrated network exists the proportion of data traffic is usually comparatively small, the data usage of individual lines ranging from 5% to 33% of the total capacity. It appears that often the reasons for using a data network are not volume of data but higher speed, efficiency and constant availability; the consequent spare capacity is therefore used for other types of communications to make better use of the network. Timesharing bureaux and most community networks are not allowed to offer voice communication over their networks.

Table 7.1. Content of data in international applications

Data Content	Information relating to		
	Objects	People	Organisations
Network Operator's Own Activities	Applications 1,4,5,7,8	Applications 3	Applications 1,2,4
Other Organisation or People	Applications 1,3,4,6,7,8	Applications 1,3,4,5,6	Applications 1,2,4,6

Notes: 1. Applications numbers as explained in section 7.1
2. Public and bureau networks are excluded.

Table 7.2. Number of Networks carrying international data in different categories

Data Content	Number of network operators processing information		
	Objects	People	Organisations
Network Operators Own Activities	16	2	7
Other Organisation or People	6	7	7

Note : 1. Public and bureau networks are excluded.

User Types and Application Types

The four basic types of network discussed in the present study - private, bureau, shared community and public - are used by different types of organisations who again use different types of applications according to their specific activities. Table 7.3 shows which user types use which applications on what type of network.

TABLE 7.3. Analysis of users of international applications

USER TYPE	APPLICATIONS USED	NETWORK TYPE
Multi-National Companies	Production and Distribution; Financial and Management; Personnel and Payroll; Credit	Private or Bureau
Business Communities	Banking Airlines and Reservations	Community
Research Communities	Scientific and Technical Research	Community or Private or Bureau
Non-Private International Organisation	Public Authorities Environmental Monitoring	Community
Non-International Organisations	Manufacturing; Production and Distribution; Scientific and Technical; Research; Financial and Management; Personnel and Payroll; Government and Public Authorities	Bureau
	General Computer Bureau	Bureau

7.4 Characteristics of Application Types

7.4.1 Production and Distribution

Applications of this type are concerned with the manufacture, processing and transport of materials and products, be they cars, oil, chemicals, engineering materials, spares, food or household products. A centralised source of information on stocks, clients, means of transport etc. obviously facilitates the planning and smooth running of operations. In our investigations we came across the following specific applications of this type:

- Manufacturing Control
- Production Analysis (Scheduling and Distribution Planning)
- Refinery and Factory Planning
- Construction and Engineering
- Order Entry and Processing
- Maintenance and Spare Parts Location
- Invoicing
- Movement of Goods
- Aircraft Weight and Balance
- Flight Planning.

Of these applications the Client Index is likely to contain what is considered to be 'sensitive information'; it is also used in conjunction with other applications such as Stock Control, Order Entry and Processing, Invoicing and Movement of Goods. Typically a client index will contain the following information.

- Name and address of Client
- Product or Product lines Client buys
- Value and frequency of Client orders
- Credit Information
- Type of Payment agreed.

Product files are also associated with some of the applications of this type. A typical product file contains the following information.

- Product Name or Code
- Description
- Stock Control Information
- Expiry Date and/or Information on Deterioration (e.g. for chemicals or food)

- Security Information (e.g. for chemicals)
- Place where manufactured
- Place where stocked.

The study found data concerning this application being transmitted internationally as shown in table 7.4.

Table 7.4. International data transmission of production and distribution information

	A	B	DK	FL	F	D	IRL	I	NL	N	P	E	S	CH	UK	USA
A																
B																
DK																
FL																
F																
D																
IRL																
I																
NL																
N																
P																
E																
S																
CH																
UK																
USA																

- Notes:
1. Only leased circuit connections considered
 2. A total of 11 private companies and timesharing bureaux only are included, as community and airline networks cover worldwide locations.
 3. Countries are identified by the international registration letters established by the U.N. (1949 Convention on Road Traffic).

As can be seen and should be expected most of the international traffic relating to this application takes place between traditionally manufacturing or raw materials producing countries: Germany, Switzerland, UK, USA and Sweden and to a lesser extent Belgium, France, Italy and other Scandinavian countries.

Of the 25 locations with host computers offering this international application type (excluding airlines) seven are in the UK, seven in the USA, three in Germany, three in Sweden, two in Italy, one in France, one in Switzerland and one in Denmark. This again reflects the predominance of certain countries in the production of goods, but is also an interesting example of national interdependence in that production and stock control data of often vital products is held in comparatively few locations.

7.4.2 Financial and Management

These applications are used for the transmission of financial and management information, often passed between the various national branches of an organisation and the Regional or International Head Office. Included under this type of application are statistical and economic analyses and forecasts, and general management aids. International data transmission obviously facilitates and speeds up the distribution of this kind of information. Where this information is vital for an organisation's operations (where for example there is a European Head Office with branches in other countries), the advantages of data transmission in this field have often been among the major considerations when setting up a network. Several of the timesharing bureaux interviewed in our study have also quoted this application as being their most important one. Using a timesharing bureau means of course that the user does not need to set up his own network but can take advantage of the timesharing bureaux's existing international links and interactive services. For example one timesharing bureau user in Belgium uses the bureau network for regular information required by his US Head Office. In another case the European HQ of a private network operator receives financial information from all its branches, consolidates it and transmits it to the US Headquarters.

The specific applications in the Financial and Management area encountered during the study are:

- Financial Statistics and Consolidation of Statistics
- Financial Auditing
- Budgeting

- Cash Flow
- Sales and Marketing
- Head Office Information
- Economic Planning (Short and Long-term Planning, Investment, Financing, Economic Models).

Of the 22 computer centres offering this type of application seven are sited in the USA, two in Sweden, seven in the UK, two in Germany, one in Switzerland, one in Italy, one in France and one in Denmark. It is interesting in this context to note the large proportion of companies operating international networks in Europe that have their ultimate Head Office in the USA. Usually the only information that a European Head Office has to give to its US office is financial (budgets, results etc.); European HQ's tend to be autonomous in all other decisions concerning their regional operations, e.g. production, transport and marketing. Therefore a large proportion of the data traffic between European and US centres can be estimated to be in the financial category.

Table 7.5 shows the traffic relating to this application between pairs of countries in Europe or the USA.

Table 7.5. International data transmission of financial and management information

	A	B	DK	FL	F	D	IRL	I	NL	N	P	E	S	CH	UK	USA
A		O														
B			O													
DK				O												
FL					O											
F			X			O										
D							X	O								
IRL									O							
I						X				O						
NL											O					
N												O				
P													O			
E														O		
S			X	X	X		X			X				O		
CH			X			X	X		X	X					O	
UK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O
USA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	O

7.4.3 Personnel and Payroll

Applications relating to staff fall of course into the sensitive category. Different companies vary considerably in the extent to which automated processing is used for staff related data. In many cases this processing is done locally because it is considered company sensitive information, or because laws, often other than specific privacy laws, restrict the processing and in particular foreign processing of such information. An example quoted to us concerned a large continental company interested in using a London timesharing service for its manpower planning, but they worried that doing this might lead to opposition and controversy.

Another multinational company has coped with this problem by allowing each of its subsidiaries to choose their own method for dealing with their personnel files and payroll, unlike other applications where common programs and computers are used.

Of all the private network operators and timesharing bureaux investigated only four offered Payroll or Personnel as an international application and all of them quoted this application as being of minor importance. Private network operators stated that personnel files are updated regularly and that an employee's file is destroyed when he leaves his employment with the organisation. Timesharing bureaux could of course not provide any information about their customers' files as these are not normally accessible by them.

The contents of the files varies according to the requirements of a particular organisation and its local branch, and also according to whether the file is only used for payroll or as a general personnel record containing the whole history of the employee. Usually files will contain:

- Where a computer is shared for personnel and payroll related data, considerable precautions are taken to prevent unauthorised access to the corresponding files and only the branch of the organisation concerned has access to its own employee's files.

The study found traffic relating to personnel and payroll applications taking place between the pairs of countries shown in table 7.6.

Table 7.6. International data transmission of personnel and payroll information

Note: 1. Countries are identified by the International Registration letters as established by the UN (1949 Convention on Road Traffic).

Applications under this category relate to those used by international banking and credit organisations and similar institutions. Specific applications include:

- Customer Transfers
- Bank Transfers
- Foreign Exchange
- Bond Markets
- Safe Deposits
- Stock and Share Markets
- Credit Authorisation
- Internal Bank Accounting and Settlements between branches.

Banks and credit companies may use their own networks and applications or make use of many standard or tailor-made packages offered by timesharing bureaux. More recently, SWIFT has opened new possibilities for banks and financial institutions and its importance in the international banking business is expected to grow considerably in the next few years.

Information stored, transmitted and processed by banks and credit organisations almost automatically falls into the category of sensitive information. Usually, files held by banks contain the following data on the customer:

- Account Number
- Name
- Address
- Branch of Bank
- Occupation
- Conditions of Payment
- Charges
- Interest Rate
- Balance.

All this information is either given by the customer or his representative when opening the account or during the course of the banking business. A credit

organisation will also hold the following information on each customer:

- card expiry date
- amount of authorisation available
- status code (e.g. stolen card, VIP status, etc.).

In the case of the credit card organisation interviewed none of the personal information stored on the client can be accessed by people other than the card issuing banks; transactions are of simple 'yes' or 'no' type unless there are special circumstances, like the case of a stolen card. It is interesting that prior to the installation of the communication network of the said organisation, files on all the many million card holders were stored in each member country of the credit system. Here we have a case where international data communication has favoured the need for privacy in that now only the customer's bank holds his file, and accessing it through the network merely means obtaining credit authorisation or credit refusal without the possibility of inspecting the file itself. Furthermore, in many countries, regulations already exist which protect customer's of banks, credit companies and similar organisations. In Sweden and Germany where privacy laws have already been passed these regulations have of course been further specified and extended.

Of all the network types covered in the study, banking and credit networks and their specific applications are subject to the highest security measures to prevent unauthorised access. Although banks and credit companies have their own very good reasons for these controls, they are also very relevant from the privacy point of view, as they protect the individual customer from unintended leakages of personal information concerning him.

It is important to note the impact and increasing use made of SWIFT (q.v) for international financial and banking transactions. SWIFT services have been available since mid 1977 and over 500 banks in 15 countries are now members of the organisation. All SWIFT traffic goes through Brussels and Amsterdam.

Apart from the two SWIFT centres, of the five computer centres implementing the applications cited above, two are located in the UK, two in the USA and one in Germany.

The sample interviewed in our study was small but representative of the purpose and usage of international networks by banking and credit organisations in European countries.

7.4.5 Reservations

International data communications has been the best answer for organisations whose activities require fast and reliable dealing with reservations, for example airlines and travel agents. Prior to the development of their present data communication networks, organisations interviewed in our study used the system of Block Allocations for their reservations. A Block Allocation consists in assigning a certain number of seats or places on specific flights, journeys or holidays to a travel agent or branch of an airline which it is then free to sell to its customers. This system proved to be slow and inefficient and often resulted in a wasteful use of the resources available. As airlines and other travel operations grew and spread internationally, efficient reservations systems became even more necessary. This need, gave rise to the present, frequently vast, data communications networks run by airlines and holiday operators. Applications other than Reservations are now sometimes used on these networks but their relative importance is considerably less.

Specific applications concerned with Reservations encountered during our study are:

- 1) Airline Seat Reservations
- 2) Railway Seat Reservations
- 3) Holiday Reservations
- 4) Freight Reservation (Planned).

All applications concerned with reservations require by definition that personally identifiable data should be held and transmitted. The following details are normally held:

- Name
- Address or telephone number
- Origin
- Destination
- Travel Details (e.g. Flight Numbers).

Airline records of reservations are usually kept for at least six months after a flight, mainly for follow-up security reasons.

Access to an airline's reservations system is open to world-wide branches of that airline and, if the airline is the national flag carrier in a particular country, also to travel agents in that country.

Most European and many other airlines make increasing use of SITA (q.v.) the automated airline reservations packet switching system, which is only used for Seat Reservations. However, only the major airlines can afford a reservations computer so they provide a service to smaller airlines; for example Iranair uses KLM's system. SITA's own reservation system is used among others by Eastern Block airlines which raises an interesting case on the issue of interdependence.

Apart from SITA, the organisations offering reservations systems include a timesharing bureau with hosts in Europe and the USA; other organisations have a host in Europe which is accessed by private lines from worldwide countries. Although the sample investigated in our study is small, if we consider the number of airlines who run a private international network and the coverage and traffic carried by SITA, we come to the conclusion that airline reservations account for a very high share of international data traffic.

Airlines take a large number of precautions to ensure both physical security of data and to prevent abuse of their reservations systems. Their measures protect their own business and at the same time their customers.

7.4.6

Government and Public Authorities

The data held by Government Departments and Public Authorities is by nature 'sensitive'. When such data is subject to international communication, additional problems arise in that the processing of a country's data in another country leads to controversy, even when such data is rendered anonymous or is presented in statistical form. Two of the timesharing bureaux interviewed in our

study, stated that Government Departments in European countries use their machine centres, located in other countries, to process their data. Often such data is encrypted to give additional security to that offered by the timesharing bureau itself. Most timesharing bureaux interviewed do in fact claim that their security is better than on the client's own premises, provided their recommendations are followed.

Interpol, the intergovernmental police organisation, was the only governmental organisation investigated in the study. It can be said that the whole reason for Interpol's existence is to facilitate the international exchange of information relating to criminals and their whereabouts. To improve and speed up this exchange of information Interpol is evaluating the possibility of converting their present teleprinter network into a proper data network with a centralised computer data base. Their files on criminals and wanted persons usually hold the following information on each subject:

- Name
- Date of Birth
- Place of Birth
- Personal description
- Photograph
- Past criminal record
- Modus operandi
- Comments on degree of danger of criminal and/or his mental health.

However, no comment on religious or political beliefs and no personal information which is irrelevant to criminal investigation is held on their records.

7.4.7

Scientific and Technical Research

Scientific and Technical Research applications are used by research institutes like CERN (q.v.) and IIASA (q.v.). International networks like EIN (q.v.) and EURONET(q.v.), which is currently being implemented will play a major role in scientific research in the near future.

Scientific research makes use of large amounts of data which may be collected from many sources; for

example, data generated by CERN can take months or years to analyse, and IIASA has collected information from sources all over the world to develop world-energy models. Telecommunications and data transmission are essential for the efficient and rapid processing of this data. In many cases international cooperation, i.e. interdependence, is necessary to put manpower and economic resources to their best use, and the many international scientific projects under way are a good example of the beneficial effects of such cooperation.

In our study we investigated a small number of research institutes so that a detailed analysis of the location using applications of this type is of only limited use. However, the main centres for scientific research we have come across were in the UK, Italy, France and Switzerland and also in Germany, Holland and Austria. The predominance of certain countries in international scientific research is also illustrated by the location of the proposed EURONET databases. Of the 27 databases planned to be offered on the network when it is opened at the end of 1978, 9 will be located in France, 6 in Italy, 5 in West Germany, 4 in the UK and one in each of Luxembourg, Denmark and Belgium. The Vienna based research institute IIASA also has temporary circuits and dial-up access to Eastern European research institutes, although these are not yet in full operation.

Data transmitted internationally for research purposes is not 'sensitive' in the sense that it does not contain any personal information. However, in some cases the actual location of international research centres may be the subject of controversy and competition between the countries involved, as in the case with the siting of the JET (Joint European Torus) project. The availability of adequate and unrestricted data communications may well be an increasingly important factor affecting such decisions in the future.

7.4.8

Environmental Monitoring

International applications of this category relate to cooperation between countries in the observation, analysis and in some cases, the control of environmental conditions and changes. The

most important of these applications are those used by countries forming part of the network of the World Meteorological Organisation. These are however, not unique. There are other existing or potential applications in this area, for example, Pollution Control, Seismographic Data, Epidemics Control.

In this survey we have concentrated on meteorological applications. These applications relate to the collection and processing of meteorological and related data used by the World Meteorological Organisation (q.v.). Without meteorological data input by the many countries forming part of the WMO network, meteorological work would be all but impossible. It is a forceful example of absolute interdependence from a specific point of view, (meteorology) and relative interdependence from a general point of view (eg. air navigation).

It should also be noted that the use made of meteorological data is not only in the meteorological field but that it is also used for other purposes such as predicting crops in remote countries, air navigation, sea conditions.

All European and practically all worldwide countries are linked to the WMO telecommunications network, inputting and receiving data. The participation of some countries is obviously more critical for the efficient functioning of the network than that of others, but in general the contributions from each country are required to achieve the purpose of the network.

We refer to the section on WMO for further details of the network and its applications.

8. ACCESS CONTROL AND SECURITY

8.1 Introduction

The security of data processing facilities and information is a matter of growing importance for the data processing community. Not only is it directly relevant to personal privacy legislation but also, and in many instances more importantly, there is great concern for the security of commercial information. In this chapter we review the security measures adopted by the network operators for controlling access to both the network (or computers) and to particular applications (or files).

8.2 Measures of Access Control

Six different levels of access control were identified amongst the networks investigated. The extent to which particular types of operators adopted the measures and considered them important is discussed in section 8.3. In this section a brief description of the actual measures and some indication of their adoption is given. The measures are as follows:

- 1) private circuit access only (i.e. no PSTN access)
- 2) terminal identification
- 3) user identifier and password
- 4) differential levels of access
- 5) manual access control
- 6) data encryption.

8.2.1 Private Circuit Access

If a network can only be accessed by terminals connected with private circuits then a first level of control is achieved. None of the operators were concerned about the possibility of tapping lines. The risk with the PSTN is that the telephone number has to be made secure as well. Of the 23 networks in the study, 11 restricted access to private circuits. Clearly this does not include bureaux, who always offer PSTN access.

8.2.2 Terminal identification

Automatic terminal identification affords a second level of control. The computer will identify a terminal by the line it is connected to or the port it has dialled into. Terminal identification usually restricts that terminal to particular applications and files, eg a car manufacturer operating a dial-in order entry system for spare parts by car dealers, will restrict the dealers to the particular order entry application. The SITA network routes traffic from a particular airline's terminal to its own reservation system and no other on the basis of the terminal identifier. Nine of the operators used terminal identification as a means of access control.

8.2.3 User Identifier and Password

This means of access control is the most commonly used - 16 operators used it, including 11 of the 12 networks which had PSTN access; the other is a research network.

Naturally all the bureaux operate user identifiers and passwords. Firstly, the user identifier is used for billing purposes and prevents free use of the timesharing facilities and secondly the password protects the customer's account because he chooses the password. Customers can change their passwords whenever they wish and are encouraged by the bureaux to do so at least once a month. However, several bureaux commented that their customers used unimaginative passwords (e.g. LOG for LOGICA) and sometimes did not change them for years on end.

The number of characters in the user identifier is a measure of the security of access; for example one bureau had an 8 character identifier which gives approximately 10,000 billion different combinations, whereas one private company only had 2 character identifiers for an order entry application file (as well as the terminal identification).

8.2.4 Different Levels of Access

Ten of the sixteen network operators using user identification and passwords also had differential access authority, by using additional passwords for particular files and passwords which would allow one user only to read a file and another to update it. One network operator had over 100 different levels of authority.

8.2.5 Manual Access Control

Manual Control covers both physical security for access to computer facilities and manual authorisation for running jobs.

Manual Control was used in cases of Remote Batch Jobs when only the operators can actually run the job and a supervisor has to authorise the job. Only five organisations operated manual control as an integral part of the access procedures though all operators used some form of physical security for access to computer rooms, and with SWIFT the banks are supposed to employ physical security for access to terminals.

8.2.6 Data Encryption

Data Encryption for storage or transmission is not widely used as most users are satisfied with the available security.

Two bureaux offered the facility of encrypted data storage, with the user providing the encryption key. One bureau stated that if the customer forgot his encryption key the data would be irretrievably lost. The most common users of the facility, at one bureau at least, are government users.

The same two bureaux which offered encrypted data storage also offered encrypted data transmission though hardly anyone used it. Two networks did use encrypted data transmission, firstly Interpol who deal with criminal records though only over a teleprinter network, and secondly SWIFT who transmit commercially sensitive financial data.

8.3 Levels of Security Adopted and their Relevance to Privacy Requirements

It is difficult to make generalisations about the adoption of security measures in the sample because of the spread of applications and security. However, it is clear that the majority of network operators have put a great deal of thought into access control procedures. The measures adopted reflect the importance of the applications used, or at least the most sensitive application on a network. Each of the categories of applications discussed in Chapter 7 will be discussed below.

8.3.1 Production and Distribution AND Financial and Management

Six private networks offered these applications. Few of them had PSTN access though all but one of them utilised user identification and passwords for access to applications.

8.3.2 Personnel and Payroll

Only one private network used personnel or payroll as an international application. The network was controlled by user identification and passwords.

Three bureaux also offered personnel and payroll applications and could, if required, be used internationally. Bureaux offer a high level of security, firstly to protect themselves against free use of their facilities and, secondly, to protect their customers' information. Though PSTN access is essential for bureaux operation, a high level of password and differential access is available, and in two cases data encryption is also available.

8.3.3 Banking and Credit Control

Financial data is highly sensitive both for personal and commercial information.

Banking and Credit probably used the highest level of security measures. The credit authorisation system only had private circuit access and the data transmitted was minimal - credit card number and credit to be authorised; the response is just positive or negative. SWIFT uses a real armoury of security measures, apart from all the standard measures discussed in section 8.2 additional measures included message sequence numbers and authorisation codes (see Appendix A21).

8.3.4 Reservations

Three of the organisations in the sample used their networks for reservations systems. In all cases the security was high, private circuits, terminal identification and in two cases, user identifiers and passwords. The third organisation is currently developing a user identification and password access system, including differential levels of access.

8.3.5 Government and Public Authorities

Apart from Interpol the only government applications in the sample occurred on bureau networks, which, as has been stated above, offer high security measures.

Interpol, at present, only use a teleprinter network for message transmission, but the data is coded and access is by private circuits.

8.3.6 Scientific and Technical Research

Security was not considered an important aspect for the three networks operating in the research field. Only basic measures were used and these for administrative rather than security reasons.

8.3.7 Environmental Monitoring

The WMO network is a leases circuit network linking message switching computers. As such, security is achieved because of the closed nature of the network.

However, WMO is not particularly concerned with security of data, except in the sense of not corrupting or losing it, because the information is not considered sensitive and can be purchased by most organisations who need it.

Table 8.1 summarises the access control measures adopted by organisations in the sample by application type.

Table 8.1. Summary of Access Control Measures Adopted

Application Type	Number of Organisations in Sample	Access Control Measures					
		Private circuit only	Term ident	ID/PASS.	DIFF AUTH.	MAN CONT.	DATA ENCRYPT
Production & Distribution AND Financial & Manag.	7	4	5	6	3	3	0
Personnel & Payroll	4	0	3	4	3	1	2
Banking & Credit Control	3	2	2	3	2	2	1
Reservations	3	3	3	1	1	0	0
Government & Public Auth.	3	1	2	2	2	1	2
Scientific & Technical Research	3	1	0	1	0	0	0
Environmental Monitoring	1	1	0	0	0	0	0

Note: One Organisation has been counted in two applications.

8.4 Access Control on the New Public Data Networks

A great deal of thought has gone into developing security facilities for future users of PSDNs. Naturally the user will still be able to implement his own controls as discussed in section 8.2, in addition the networks will be offering other facilities described below.

8.4.1 Closed User Groups

A group can be formed of terminals (and computers) such that an outsider to the group cannot access the group, and a member of the group cannot access facilities outside the group ie a private switched data network.

8.4.2 Direct Call Facility

If a terminal only accesses one other terminal (or computer) then a direct call facility can be programmed into the network such that when the user puts in a call request he is directly connected to that distant terminal.

8.4.3 Calling Line Identification

The network transmits the address of the calling subscriber to the called subscriber before the call is put through. If the called subscriber does not wish to accept the call then he can clear immediately. The facility is intended to give subscribers the possibility of checking identities and since it is the network that passes the identity, the calling subscriber has no opportunity for falsifying his identity.

9.1

Costs

Many of the network operators interviewed were unwilling or unable to quote figures for the overall cost of their international networks. In any case, many organisations do not necessarily distinguish the cost of their data networks from data processing costs as a whole, or from their other communications costs. However, in most cases it was possible to arrive at a close estimate of the annual rental cost of the international lines in each network, either using figures provided by the interviewees, or from the tariffs quoted by Logica's Tarifica telecommunications information service.

The results of these estimates are shown in Table 9.1. Roughly speaking, the total data communications cost to the operator of a private network will be about twice the cost of the private circuits. This approximation includes both the salaries and other costs of the staff operating the network and amortisation of the user equipment involved in it. The actual ratio in each case will depend on the complexity of the network and the range of functions it includes. The total cost may range from less than 1.5 times the circuit cost for a simple network, to as much as 5 times the circuit cost in cases where the network includes a great deal of user equipment and carries out important functions in addition to the simple transport of data.

International private circuits generally cost at least \$20,000 per year, even between neighbouring countries, and none of the networks surveyed had circuit costs of less than \$40,000 per year. At the other end of the scale, a number of big networks have circuit costs in the region of \$500,000 and \$1 million per year. SITA spends about \$20 million a year on circuits, but this figure includes a very extensive teleprinter network covering almost the whole world and it is not possible to separate out the data element.

Figures for the amount of traffic carried by these networks are much less accurate, and some of those shown in Table 9.1 should be regarded as order-of-magnitude estimates only (in some cases only those parts of the network for which we had details are

included). However, with the exception of SITA whose costs are higher because of the large proportion of low-speed circuits in the network, the estimates in the table all point to circuit costs in the range from 1 to 10 cents per 1000 characters.

Many of the networks studied are operated, at least to some extent, as an alternative to telex, and if these costs are compared with the prevailing level of international telex tariffs one of the main financial reasons for the move to data transmission becomes clear. To transmit 1000 characters takes 2.5 minutes on the telex network. Throughout most of Europe, an international telex call costs upwards of 60 cents per 1000 characters; transatlantic calls cost about 10 times as much. Thus the use of data transmission can cut the cost of sending a message by a factor of from 10 to 100 compared with using the international telex network.

Table 9.1 Costs of Private Networks

Network	Annual Line Rental (\$1000)	Annual Traffic (M characters)	Cost per 1000 chars (US cents)
O	700	72,000	1
D	310	12,000	3
IIASA	50	1,200	4
L	567	15,000	4
A	47	500	9
I	150	1,500	10
J	300	3,000	10
K	113	1,000	11
SITA	20,000	100,000	20

It would be interesting to compare current operating costs with possible future costs of using the new public data networks. However, only proposed tariffs exist for three networks; TRANSPAC, Swedish tariffs for the NORDIC network, and EPSS which is unlikely to go into full commercial operation, and operational tariffs exist for IDN. All the same it is possible to make some simple comparisons of charges. The public networks will have two regular components to the tariffs; an access rental tariff, and a usage related tariff. It would be as difficult to include the access rental in the comparison as it would be to

include the cost of the private network's sophisticated communication equipment; so we will make the sweeping assumption that these costs are equatable. It is now possible to compare the cost of transmitting 1000 characters over public networks to the cost of transmitting 1000 characters over leased lines as shown in Table 9.1. Table 9.2 shows that the new public networks will charge 0.7 to 1 cent per thousand characters. The estimate of the Nordic tariff was made on the basis of 100% efficient transmission as the tariff is based on time not volume. A similar approach was used for IDN with additional assumptions of 2400 bps transmission for a distance greater than 100km. The recent Euronet tariffs have also been used for a comparison, the assumption used was a 1200 bps terminal (for the volume sensitive networks some account had been taken of the charge for call duration).

Table 9.2. Charge for Transmitting 1000 characters over Public Data Networks (US cents)

EPSS (For UK traffic)	0.7
NORDIC (For International Scandinavian traffic)	0.9
TRANSPAC (For French traffic)	1.1
IDN/EDS (For German traffic)	2.7
EURONET	3.5

9.2

Economics

To consider the implications of the circuit and character costs it is useful to divide the networks studied into three types; transaction-orientated

networks (airlines, reservations, banking); corporate management networks (mainly operated by multinational companies); and resource sharing networks (bureaux and equivalent operations).

Transaction orientated data transmission applications typically entail the sending of 50 to 300 characters per transaction, giving a circuit cost of from 0.5 to 3 cents per transaction. For networks dealing with such things as airline seat reservations typically worth \$100 each or more, this cost is relatively small, and the network would still be economically justifiable even if circuit charges were increased by 50% or doubled. However, banking networks are working in an environment where the value of the transaction to the user - i.e. the commission collected by the bank - is much smaller and a large increase in circuit charges would seriously threaten their economic viability.

Corporate management networks can also provide relatively large financial benefits in relation to their cost. A major application in all these cases is stock and production control of an internationally distributed network of factories and marketing operations. Each of the network operating companies interviewed in this category have turnovers of at least hundreds of millions of dollars per year, and in many cases billions of dollars. The scope for savings in these companies by efficient management systems is obviously large compared with the total costs of the network, and the financial advantages are further strengthened by the additional applications which most of these networks carry. Thus these networks would probably remain economically worthwhile even if circuit charges were increased substantially. At the same time such an increase would seriously reduce the rate of development of systems of this type particularly for organisations with smaller turnovers.

The situation with resource sharing networks is very different. In these cases, the cost of the international circuit usually has to be balanced very carefully against the value of the computer time to which provides access to. For example, one bureau pointed out that the savings from selling off-peak time at its US computer centres in Europe are more or less equal to the cost of the private circuit required to make this possible. Even a small increase in circuit charges could result in some of

these resource-sharing links being closed down, and a reduction would probably bring a substantial increase in the number of international circuits dedicated to this application.

APPENDIX A

Network Descriptions

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Summary - Organisation A

NETWORK OPERATOR

A is a multinational manufacturer with headquarters in a European country.

USERS

A has three types of users: manufacturing plants, importers and dealers; the latter two types are external to the organisation.

APPLICATIONS

Manufacturing plants use the network for details about production, distribution, financial auditing, personnel administration and sales. Importers and dealers use dial-up access for product or Spare parts order entry and invoice retrieval.

FUTURE DEVELOPMENT

A is currently studying the requirements for a full network to be implemented in 1980.

PRINCIPAL CHARACTERISTICS

The network consists of leased lines from the European headquarters to two European locations, one line being used for data transmission only and the other for both data and voice. In addition, from practically every European country, users can access A via 1200 bps dial-up lines.

HETEROGENEITY

Technically the network is very homogeneous, oriented to one equipment manufacturer. Terminal types vary, but emulate one make.

SECURITY OR SERVICE

Passwords are required to access specific applications, and each terminal has its own identification number.

COSTS

The inland network lines plus the most important international line cost about \$170,000 p.a. in rentals. Importers and dealers pay their own terminal, modem and international telephone charges.

Appendix A1

ORGANISATION A

1) Introduction

A is a multinational manufacturer with headquarters in a European country. It also runs main factories in two other European countries. Although each factory has its own computing resources, A also operates generally available computer facilities. However, A companies can choose where to do their data processing.

A section within A is responsible for all decisions concerning hardware and communications that ought to be offered to A companies.

A is currently studying the requirements for a full network to be implemented in 1980.

2) Configuration of the network

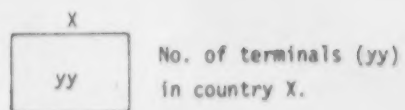
A map showing the configuration of A's network is given in Diagram A1.1. One of the international lines leased by A is used for data transmission only, the second is used for both data and voice. In addition, from practically every European country, importers and dealers can access A via 1200 bps dial-up lines. Technically the network is very homogenous, oriented to one equipment manufacturer. Terminals are of many types but emulate the protocols of one manufacturer.

3) Applications

A has three types of users:

- a) Manufacturing Plants
- b) Importers
- c) Dealers

and it is best to discuss applications by client type.



Existing line

Dial-up line

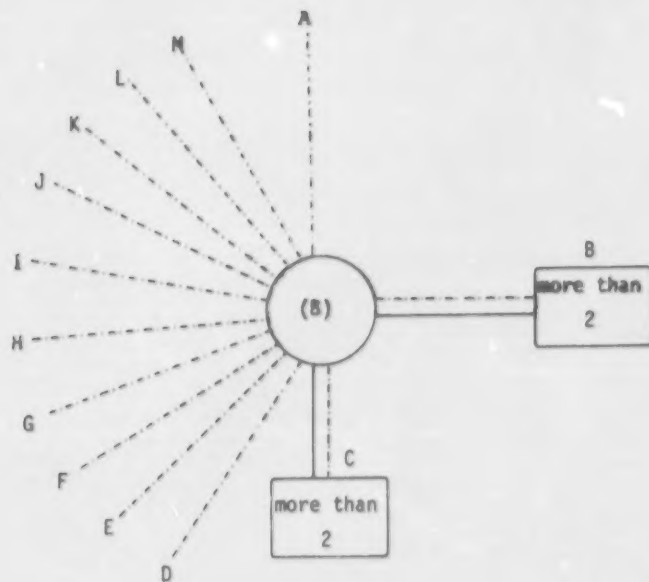


Diagram A1.1. 'A' Network Configuration

a) Manufacturing Plants

This type of user has access to the following applications

- Parts and Materials Control and
- Distribution
- Financial Auditing
- Personnel Administration (not an international application)
- Sales.

As has already been stated, many A companies have their own data processing facilities and use A either as an additional resource or for common software packages. In fact, A carry out Personnel Administration only for the headquarters's factories.

In theory A has a system whereby importers and dealers send their requirements to A who then calculate production and distribution schedules and transmit these to manufacturing plants. In practice this system does not yet work smoothly and dealers often contact the manufacturers directly.

b) Importers

Importers dial-up A for product or spare parts order entry and to receive invoices. There is normally one importer per European country.

c) Dealers

Dealers use dial-up access for spare parts order entry and invoice retrieval. There are many dealers in each country.

4) Security and Privacy

Each terminal has a two-digit identification number and passwords are required to access specific applications. Security is limited in the sense that it would not be difficult for a dealer to establish other dealers' identities and then access their sales statistics or put in false spare part orders.

5)

Traffic Types

Most of the traffic falls into the batch processing and bulk data transfer category (about 10^{16} characters per year for both), but a fair amount of traffic is interactive (about 2.5×10^9 characters per year). On one of the international lines the traffic is 2×10^6 characters per day. Traffic volumes on other lines were not known.

6)

Financial Aspects

The inland network lines plus one of the international lines (the most important one) cost about US\$ 170,000 per year in rentals paid by A. However, every importer and dealer has to pay for his own terminals, modems and international telephone calls.

A have been following the development of new public data networks and they are very interested in them. They will almost certainly use their country's public data network, once it is set up, for importers and dealers, but not for factories. A believe that this public network will not be suitable for the larger volumes of data. They are also very interested in the Euronet concept for their European dealers and importers. A are also confident that volume sensitive tariffs can only benefit them as their network covers long distances and carries low volumes of traffic.

Summary - Organisation B

NETWORK OPERATOR

B is an international credit card organisation which is jointly owned by the licensee banks using the B system. The B Board is responsible for setting up new links to the network.

USERS

Only licensee banks are allowed access to the network.

APPLICATIONS

The network is used internationally to authorise credit purchases made by B customers in other countries. B plan to introduce a further application, 'Clearing' by 1978, to debit a credit card holder's account during a transaction.

FUTURE DEVELOPMENT

It is expected that within five years all countries in which licensee banks operate will form part of the network.

PRINCIPAL CHARACTERISTICS

An international message switching network with a computer centre in the USA, to which the licensee banks are linked. Signalling rates vary between 2400 and 9600 bps, according to volume requirements.

HETEROGENEITY

Terminal types vary, but emulate those made by the manufacturer of the main computer.

SECURITY OF SERVICE

Privacy is ensured to the maximum level possible and security is provided by means of dedicated lines and passwords, as well as security buildings.

COSTS

It is estimated to have cost about \$25,000 to install the line from Europe to the USA and to buy the necessary terminals. The yearly rental for this line amounts to about \$100,000.

Appendix A2

ORGANISATION B

1) Introduction

B is an international credit card organisation which is jointly owned by the licensee banks using the B system. The B Board, made up of representatives of the licensee banks, is responsible for all fundamental decisions concerning the organisation, including the set up of new links to their network.

The network was first started in the USA about five years ago to link US licensee banks. Other countries were added later and it is expected that within five years all countries in which B operate will form part of the network. Only licensee banks are allowed to access the network.

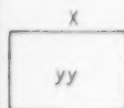
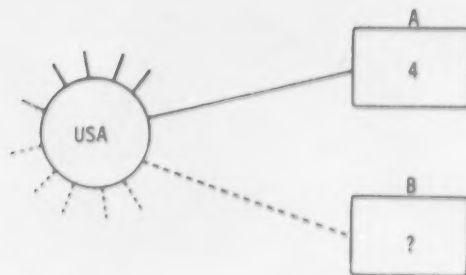
Setting up a data communications network has permitted greater speed and efficiency in dealing with credit payment authorisation. Authorisation using the network can now be given in almost a tenth of the time required by the previous telex and telephone methods.

2) Configuration of the Network

B uses a computer centre in the USA, to which the licensee banks are linked. The network is of message switching type and signalling rates of lines range between 2400 and 9600 bps, according to volume requirements. Terminal types vary, but emulate terminals made by the manufacturer of the main computer.

3) Applications

At present B uses only one international application called 'Authorisation'. As the name implies it is used to authorise credit purchases made by B customers in other countries. It is basically a 'yes' or 'no' system which includes the amount authorised for payment, but not the credit limit or any other details of the client.



No. of terminals (yy)
in country X.



Host Computer



Existing line



Planned line

Diagram A2.1. 'B' Network Configuration

Each card-issuing bank holds the data files about its own customers, i.e. there is no central database of all customers. Information held on each customer file consists of:

- account number
- card expiry date
- amount of authorisation available
- status code (e.g. stolen card, VIP status).

There is, however, a central negative file held in the machine centre in the USA. It contains details of only those card-holders for whom authorisation of payment must not be given. It is also used as a contingency only, for occasions when the card-issuing bank's files are inaccessible due to breakdown, holiday, closing hours, etc.

Files are updated every night. If a customer ceases to be a card-holder his file is kept for one year before it is purged.

It is interesting that before the present network was set up, each member country of the B system held details on the millions of B card holders on microfilm in his own country. Now files are only kept by the customer's own bank (with the exception of the negative files mentioned).

B plan to introduce a further application, 'Clearing' by 1978, which will involve debiting the credit card holder's account during the transaction, making the appropriate settlements.

4)

Security and Privacy

B, like many organisations of its type, is required by law to provide adequate security and it has, of course, its own reasons for being security conscious. B uses dedicated lines and passwords, as well as security buildings.

Privacy is ensured to the maximum level possible as transactions are of a mere 'yes' or 'no' type, unless there are special circumstances, such as the case of a stolen card.

5) Traffic Type

Traffic is 100% message switched.

6) Financial Aspects

The yearly rental for the line from Europe to the USA amounts to about US\$ 100,000.

B are well aware how dependent they are on the PTTs to carry on with their business. A change-over to volume-sensitive tariffs may either be convenient or catastrophic to them, depending on the level at which tariffs are set. B are not in favour of using a public network, particularly not if packet switched, as they believe security problems would arise.

The charging structure for network use consists of a charge per transaction to the card issuing banks.

Summary - Organisation C

NETWORK OPERATOR

C is a large group of companies operating in 75 countries. A division in one of C's European centres is responsible for the operation of a network for the benefit of all C companies.

USERS

The network is used for communication between different C companies.

APPLICATIONS

Applications include orders, stock control, invoicing, client index and payroll, but not all are subject to international traffic.

FUTURE DEVELOPMENT

All European countries in which C operate should be linked to their network within roughly five years. C also plan to extend their line capacity to one of their international locations in the near future.

PRINCIPAL CHARACTERISTICS

Inland networks exist in each of three European countries with two European links consisting of M102 telephone lines. International lines are used for voice and telex communication, and data transmission at a speed of 4800 bps. C also operate an international message switching network and have access to Telenet and a bureau network in the USA.

HETEROGENEITY

Computers are mainly, but not exclusively, of one make, and a variety of makes are used for terminals.

SECURITY OF SERVICE

C are very concerned about security and adopt such measures as keylocks, badges and passwords to restrict illegal access.

COSTS

The total circuit rentals for the C network amount to about \$850,000 p.a.

Appendix A3

ORGANISATION C

1) Introduction

C is a large group of companies carrying out a variety of activities in 75 countries. Within the framework of agreed policy, C operating units and companies are free to carry on their operations with a minimum of central control and supervision from Head Office, which is located in Europe.

A division in one of their European centres is responsible for managing and operating a telecommunications network for the benefit of all C companies. This division requires authorisation from the Board for major decisions where high capital expenditure is involved.

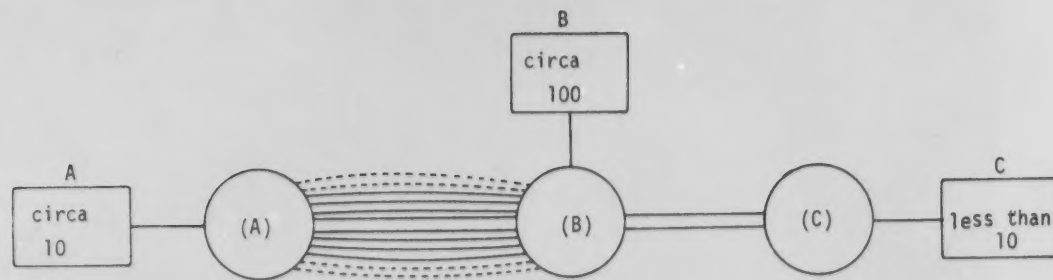
The C network, which started operating in its present form in 1975, was set up to facilitate communication between different C companies, although no C company is required to use the network. It is left to each company to decide on the best form of communication.

C companies in all European countries should be linked to the network in about 5 years.

2) Configuration of the network

Currently one of the European links comprises 8 M102 telephone lines and the other 2 M102 telephone lines. Inland networks exist in each of the three countries. International circuits are used for data, voice and telex communication. Data transmission between different countries takes place at 4800 bps. Computers are mainly, but not exclusively, of one make, and a variety of makes are used for terminals.

C plan to extend their line capacity to one of their international locations in the near future. The original plan of having a single wideband circuit has been opposed by the PTTs involved and C are now prepared to settle for 12 telephone lines instead of wideband circuit.



100

X

yy

No. of terminals (yy)
in country X.



Host Computer



Existing line



Planned line

Diagram A3.1.

'C' Network Configuration

Separately from their data and voice network, C also run an international message switching network which covers mainly African and Asian countries. C also access Telenet in the United States and if usage justifies this, they will apply to the authorities involved to have their own port directly connected.

A further facility consists of access to a bureau network in the USA which is partly owned by C.

At present C's international links in Europe are manual, i.e. operator intervention is required. It is expected that by 1978 this will be changed by installing fully automatic facilities. Once this happens, automatic access to the US bureau will be available to all European countries linked by the network.

3) Applications

Applications supported by Host Computers are numerous including Orders, Stock Control, Invoicing, Client Index, Payroll, but not all are subject to international traffic. International applications are mainly Stock Control and Invoicing. Specific applications and data files depend, of course, on the activity pursued by each individual C company.

4) Security and Privacy

C are very concerned about leakages of information and take a series of measures to ensure security of data. Only authorised operators may access the network and various security measures are used to restrict illegal access, such as keylocks, badges, passwords. Security is also one of the reasons why C prefer to use a private network as it means that if leakages occur, they will at least remain within C.

5) Traffic Types

As mentioned above, the use of international lines is still manual which limits their use to about 8 hours a day. During 50% of that period at least one of the 10 international circuits is used for data transmission.

Details of the traffic types on these circuits were not available, but it is probably mainly batch processing. For the total C network the percentage of traffic for different traffic categories is as follows:

Interactive Work	:	34%
Batch Processing	:	43%
Bulk Data Transfer	:	8%
Message Switching	:	15%.

6)

Financial Aspects

The total circuit rentals for the C network amount to about US\$ 850,000 per year.

C are very much against the idea of volume sensitive tariffs for their network. If such tariffs were introduced C would look at new technologies to overcome the disadvantages that such a system would mean for them. Considering the vastness and complexity of their established national and international networks, C do not intend to use any of the public networks that are becoming available.

Summary - Organisation D

NETWORK OPERATOR

D is a worldwide engineering group of 230 companies and factories operating in 18 countries.

USERS

The network is used by the departments of D concerned with forecasting and sales strategy.

APPLICATIONS

All applications relate to production and distribution.

FUTURE DEVELOPMENT

The group's telecommunications section is carrying out a technical evaluation of an on-line network.

PRINCIPAL CHARACTERISTICS

The network consists of 9600 bps lines from D's European headquarters to five European locations, all but one of which connect to the network by computer. Each computer has its own local collection of terminals but these do not use the network. The computers themselves act as remote terminals.

HETEROGENEITY

The network is oriented to one equipment manufacturer.

SECURITY OF SERVICE

Adequate security is provided for by various measures such as authorisation of file transmission.

COSTS

The annual cost of the international circuits and related equipment amounts to about \$300,000.

Appendix A4

ORGANISATION D

1) Introduction

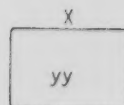
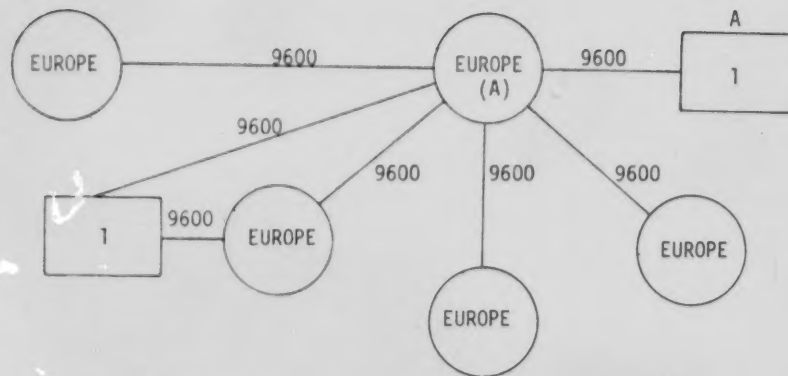
D is worldwide engineering group of 230 companies and factories operating in 18 countries. The group is divided into several divisions, one of which is concerned with the manufacturing and sales companies in Western Europe.

Originally, each manufacturing company produced all its own local sales requirements using batch production. Faced with increasing costs and stiff competition, particularly from Japan which has low labour costs, the European Division decided to rationalise its manufacturing and sales strategy. Since then it has used a co-ordinated production and distribution system for that purpose. Now sales offices located in the various countries forecast requirements and the central stocks are moved to local stores by means of a transport distribution system. Only the European countries with manufacturing centres are involved. An export sales office at headquarters deals with the requirements of other sales offices. A forecasting office in another country plans and controls the whole operation; it is jointly run by the European manufacturing companies involved.

Clearly this type of sophisticated planning and control required an information network and so the D communications network was created; it began transmitting data in 1976.

2) Configuration of the Network

A map showing the configuration of the network is given in Diagram A4.1. As can be seen, all except one of the international locations connect to the network by computer. Each of these computers has its own local collection of terminals but these do not use the network. The computers themselves act as remote terminals sending and receiving data to and from Headquarters. The network equipment conforms mainly to the protocols of one manufacturer.



No. of terminals (yy)
in country X.



Host Computer



Existing line and speed (bps)

Diagram A4.1.

'D' Network Configuration

3)

Applications

All network applications relate to the production and distribution system, which involves the following:

a) each sales office calculates the following monthly details:

- forecast sales by product type,
- actual sales by product type,
- local stock situation by product type.

These three files are transmitted monthly by each office to Headquarters.

b) the global and local figures are then used by the forecasting office to calculate:

- capacity booking
- manufacturing programme
- assembly scheduling
- distribution schedules

for each manufacturing plant and its associated central stock. This information is sent monthly to the manufacturing centres.

Applications are therefore as follows:

- Monthly file transmissions from remote centres to headquarters of sales forecasts, sales actual and local stock;
- Access of above files and files relating to manufacturing capacity and related information of each plant by the forecasting and supply office, which as mentioned, is located in a European country other than that of Headquarters;

This forecasting and supply office does Production Planning and Distribution calculations using either the computer at HQ or that of one other European country;

- Monthly file transmission from HQ to remote centres giving manufacturing, assembly and distribution schedules.

In addition, there is one new experimental application. The export sales agency at HQ has on-line access to the central stock database. If the agency receives an order which cannot be met by its reserve stock - the agency does not have a local stock but has a reserved stock at each central store - then it can access the central database located in another country to see if the order can be met immediately. However, it cannot update the database; this must be done via telephone or telex. If this experiment is successful all sales offices will have access to all central stock databases. At the same time as the application is being evaluated the group's telecommunication section is carrying out a technical evaluation of an on-line network.

4) Security and Privacy

Adequate security is provided for by various measures. For example, file transmissions have to be authorised by supervisors.

Terminals local to a particular computer cannot access the network because such a facility is just not available. The export agency terminals, though located at Headquarters, are in fact 'local' terminals to a computer in another European country sharing the 9600 bps line by means of a multiplexor.

D are not concerned about privacy regulations as none of their international data transmission refers to personal information.

5) Traffic Types

Different traffic types and volumes transmitted over the D network are as follows:

Interactive	- Export Sales Office	3×10^6 characters per year
Batch Processing	- Forecasting and Supply Office	11×10^9 characters per year
Bulk Data Transfer	- File transmissions to and from Headquarters	4×10^8 characters per year

6)

Financial Aspects

The annual cost of the international circuits and related equipment amounts to about US\$ 300,000. The costs are divided equally between the five manufacturing companies, but from next year each company may just pay its own share.

Looking at the future, D considered using Euronet for their more sophisticated network, but two considerations prevent this:

Firstly, D need the network by 1980 at the latest and they doubt that equivalent public facilities will be available by then.

Secondly, D have tried to find out if access to Euronet will be available from different countries and have not received adequate replies.

D believe that volume sensitive tariffs for leased circuits cannot benefit them because they expect that the PTT's only objective is increased revenue. A great deal of capital investment has been made to utilise the very expensive leased lines as much as possible; therefore they would either have to pay a high volume tariff or use their lines less efficiently, thereby losing their capital investment.

Summary - Organisation E

NETWORK OPERATOR

E is a major European airline offering worldwide flights.

USERS

The network is accessed by international E staff for the purpose of seat reservations.

APPLICATIONS

The international applications are seat reservations, flight planning and aircraft weight and balance.

FUTURE DEVELOPMENT

The addition of national travel agents to the network is to take place shortly, and E are also considering the installation of a link to their national PTT network.

PRINCIPAL CHARACTERISTICS

At present 17 countries are connected to the computer centre, and data transmission is offered at a speed of 2400 bps, with a few circuits operating at 1200 bps and 9600 bps. Traffic is 100% interactive, and the number of terminals is well over 700.

HETEROGENEITY

The system is based on three computers, all by the same manufacturer, and a variety of makes is used for terminals. Access is also possible by telex and E are linked to SITA for low speed telegraph traffic.

SECURITY OF SERVICE

E adopt a very high level of security, employing such measures as passwords, terminal addresses, and access control for the protection of data, and tight security checks for the physical protection of the system.

COSTS

The costs of operating the network were not available.

Appendix A5

ORGANISATION E

1) Introduction

E is a major European airline offering worldwide flights. Their telecommunications network was developed to meet their seat reservations needs, which is still their main application.

The network started operating first at the national level, and the first international link was set up in 1970.

A division at Headquarters is responsible for managing and operating the telecommunications network, and another division is responsible for data processing.

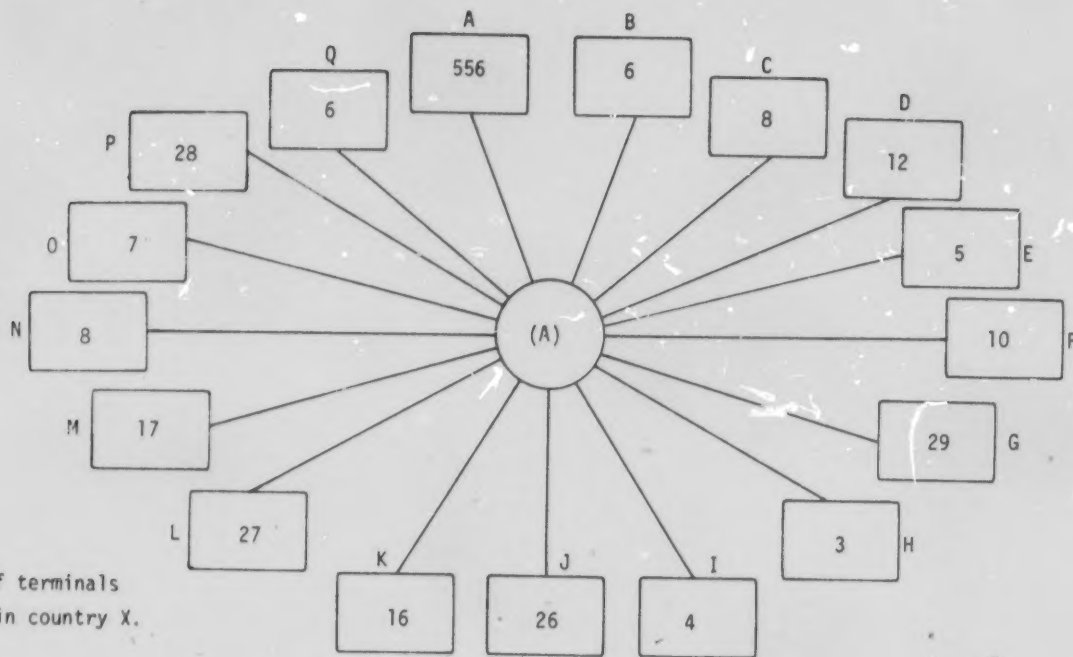
2) Configuration of the Network

At present terminals are distributed between 64 sites in 17 countries. The job of adding national travel agents to the network will double the number of installation points shortly. In less than one year 140 more sites are to be added. By IATA agreement, travel agent terminals are provided by the national flag carrier in each country. Therefore E will not have any links to agent terminals outside its own country.

E uses a reservation system originally based on two computers, but now based on three. Extensions and changes in software have also taken place over the years. The network is extended as E's Commercial Department finds suitable new sites and extends service to new areas. E expects to make increasing use of SITA in the future, particularly as Class A (data) traffic by SITA is now increasingly stabilised.

Terminal speeds are mostly 2400 bps but a few circuits including one to the USA are 9600 bps degraded to 7200 bps in some cases. Shared links, e.g. satellite circuits, are 1200 bps.

E are linked to SITA for low speed telegraph traffic and are considering the installation of a link to



X
yy
No. of terminals
(yy) in country X.

X
Host Computer

Existing line

Diagram A5.1. 'E' Network Configuration

their national PTT network.

The network is also used for telex and to a small extent for voice communication (for maintenance and control). Lines are multipoint in some places. Manual switching around failures can be done where loops are available.

3)

Applications

The international applications are Seat Reservations; Flight Planning and Aircraft Weight and Balance. Seat Reservations is by far the most important. It is a standard airline reservation system and thus it carries passenger names, flight numbers and other conventional details, being typical in this respect of many airlines. Flight Planning and Weight and Balance applications use files with information on meteorological data, flight plan regulations, aircraft specification, etc. Flight Planning and Aircraft Weight and Balance are closely related applications. The first concerns the organisation of routes and altitudes, etc. in the light of weather conditions; the other is similar. They have limited international use at present because they only show large benefits on long flights and the scope for flexibility on routing within Europe is limited in any case. Additional possible future applications are Crew Scheduling and Cargo Reservation.

4)

Security and Privacy

Security requirements are considerable, concerning both data security and physical security of the system. As far as data security is concerned, three levels apply:

- 1 - Normal security of office,
- 2 - Password, per individual, defining permitted access; there are over 100 different levels and combinations,
- 3 - Terminal address; facilities are also restricted according to the terminal used.

Each user only has access to the applications or partial applications he needs; there are over 100 possible categories of access.

Because there is a problem with fraud, the system has to be well protected. In particular the central reservations department has the responsibility of determining which reservations are fake. This is done by manual inspection of files by trained staff to pick up abnormalities. In some cases only a sample of transactions is analysed, in others every one.

For example, a person may try to make a cancellation of someone else's place so that he can get a flight himself. Or a travel agent may place a large number of fake bookings for a peak period, aiming to cancel them and put his customers in their place when the time comes. Or the passenger name register may be used to send messages, for example by putting information in the name. The checkers are trained to pick up this sort of thing by scanning the records, which are also kept for at least six months after a flight. Each entry is identified with the person and terminal which made it so that follow-ups can be made.

Corresponding to this, there are different grades of operator, e.g. normal, qualified and supervisor. For example, some operators may be able to book only up to 4 seats per transaction, a supervisor may be able to book up to 20, and for larger numbers it will be necessary to check with HQ. Some operators can ask about the loading of a particular flight but not others - particularly not non-E offices, (i.e. travel agents), when service is extended to them. Only a very restricted number of staff can change password signatures.

Physical security is also a major concern. The E site has tight security checks at the gate; there is an additional security ring round the computer complex itself, and similar protection for power supplies, air conditioning etc. A vault is planned for storing master files, and security round key telecommunications centres is also tight.

Privacy laws are just not a problem they have yet encountered and they knew little of plans in this area for their country.

5) Traffic Types

Traffic is 100% interactive. No figures on the actual volume of traffic were available, but the computer deals with 30-40 transactions per second.

6) Financial Aspects

The costs of operating the network were not available. E made the point that if the PTTs introduce usage-related changes for private circuits this would have a big effect on their traffic pattern, particularly if it put costs up by as much as 10 times as SITA has suggested. If such usage-related charges are introduced, E will make every effort to reduce traffic, for example by decentralising the computer systems. E felt that this would be good neither for E, nor for the PTTs.

E itself has no internal tariffs as such; instead costs are allocated in bulk to different users. For example seat reservation costs are allocated to the Commercial Department and flight planning costs to the Operational Department.

Travel agents who are about to be connected to the network will pay a monthly fee not yet specified for a terminal. Probably the fee will be just the cost of the terminal and the necessary line. It is against IATA rules for E to derive a profit from the services.

Summary - Organisation F

NETWORK OPERATOR

F is a holding company with 11 major subsidiary companies operating mainly in manufacturing. Group co-ordination is very decentralised and so there is no group-wide network.

USERS

No information was available about the subsidiary companies. The holding company operates a telex network which is used by administrators.

APPLICATIONS

The network is not used for data transmission but for general administrative functions such as finance, strategy and control.

FUTURE DEVELOPMENT

The need to co-ordinate F's future telecommunication requirements may lead to a group-wide data and voice network. However, they think it is still too early to consider such a network. F also expect that as far as one major manufacturing sector is concerned, some locations will be internationally linked by computer, particularly for passing information about spare parts.

PRINCIPAL CHARACTERISTICS

F's international telex network uses the national public message switching system and connects the holding company with five overseas locations. They also have a 1200 bps AVD line to the USA.

HETEROGENEITY

Not applicable.

SECURITY OF SERVICE

Not applicable.

COSTS

Not applicable.

Appendix A6

ORGANISATION F

1)

Introduction

F is a holding company with eleven major subsidiary companies operating in eleven sectors, mostly manufacturing. All told there are some 500 to 600 F companies all over the world. Each of the eleven sectors is an autonomous section within F reporting to two committees, a Co-ordination Committee and a Management Committee.

Since 1974 F has been operating a very decentralised system of co-ordination. As a result, within the data transmission environment, each of the eleven sectors controls its own requirements. The interview was held with the Informatics Department of the holding company who are not aware of what the other companies are doing in telecommunications. Their own role is to develop data processing and telecommunications requirements for the holding company, to negotiate overall terms and conditions with manufacturers and suppliers of equipment to all F companies, and to consider and co-ordinate the future requirements of F as a whole in telecommunications. This third objective may in the future lead to a group-wide co-ordinated data and voice network. However, they themselves said that it was still too early to consider this network.

2)

Configuration of the Network

The holding company has an international telex network using the national public message switching system. The network connects F holding company with five overseas locations. They also have a 1200 bps AVD line to the USA which is used primarily by one major manufacturing sector, although the holding company also uses it for telex traffic linking other locations in the US via the Aircon system.

There is an extremely large number of computers within the F organisation. From Logica sources it seems that there are computers located in the following countries: England, Germany, Italy, France, Sweden, Netherlands, Switzerland, Belgium, Denmark, Austria and the US. The holding company expect that

as far as one major manufacturing sector is concerned, some of these computers will be linked together, particularly for passing information about spare parts. However, they cannot provide any details about the other sectors.

It also make substantial use of various services such as the GE Mark III network and economic databases in the US such as Data Resource.

3) Applications

The telex network is not used for data transmission but for general administrative functions such as finance, strategy and control.

4) Security and Privacy

Not applicable.

5) Traffic Types

Telex traffic.

6) Financial Aspects

Not applicable.

Summary - Organisation G

NETWORK OPERATOR

G is one of the world's large oil companies, whose European HQ is wholly responsible for their European network.

USERS

The network is used internally by the various departments of G.

APPLICATIONS

International applications include company accounting, order entry, invoicing, stock control, financial reporting, and refinery design and management.

FUTURE DEVELOPMENT

G plan to improve and extend their European network considerably within the next few years. A new switching system is under study and the siting of another host computer in a European location is planned.

PRINCIPAL CHARACTERISTICS

The G telecommunications network is worldwide, with host computers at present sited in one European and two US locations. Their European circuits and lines to the USA are used for both voice and data traffic. G also have an international message switching system, which connects locations all over the world.

HETEROGENEITY

Main computers and terminals are of one manufacturer's make.

SECURITY OF SERVICE

At present G's data security is based on standard computer manufacturer's software, but they expect to have their own security system shortly.

COSTS

G's European communications system cost about \$21m last year, including staff costs. In 1974, their worldwide telecommunications costs amounted to about \$70m and G believe that this figure has since increased by about 30%.

Appendix A7

ORGANISATION G

1) Introduction

G is one of the world's large oil companies and all its activities revolve around the production, refining and distribution of oil and oil derived products. For management and operational purposes there are four G Regions:

- USA (with HQ)
- Latin America
- Far East
- Europe.

Their telecommunications network was set up to achieve rationalisation, higher speed of communication and efficiency. Their European HQ is wholly responsible for their European network and their telecommunications Manager is answerable to the European Management. Different regions do, of course, share resources and co-ordinate the best use that can be made of telecommunications, computers and other facilities.

2) Configuration of the Network

Diagram A7.1 shows the configuration of the worldwide G telecommunications network. Their European network circuits and the lines to the USA are all used for both voice and data traffic. Host computers accessed by European locations are at present sited in one European and two US Locations. Main computers and terminals are of one manufacturer's make.

G plan to improve and extend their European network considerably within the next few years. A new switching system (programmable computer switching) is under study and extra lines to the existing European location together with the siting of a host computer in another European location are planned.

G also have an international message switching system, which connects locations all over the world.

X
yy

No. of terminals (yy)
in country X.

X

Host Computer

Existing line

Planned line

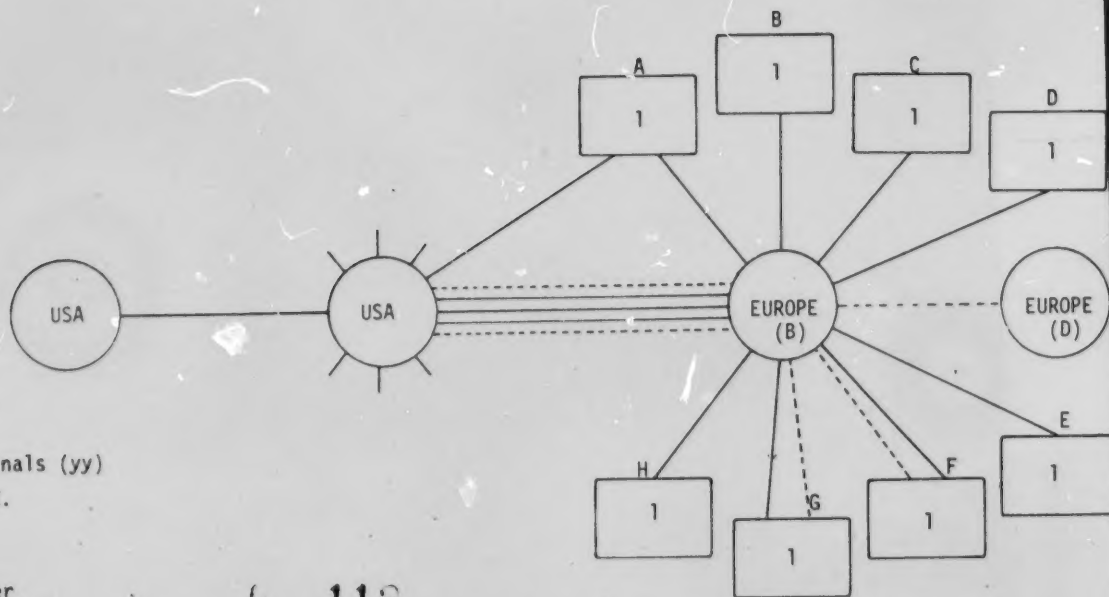


Diagram A7.1.

'G' Network Configuration

3)

Applications

The applications supported by the host computers used by the European locations are largely, but not wholly, duplicated in each centre. G are currently taking steps to rationalise further by specialising the European centres for certain types of work. Some applications are only available at one of the host computers; for example, one host provides a timesharing service for one application - Refinery Management - which is frequently accessed by a European site.

The applications used include the following:

- a) Refinery Design and Planning (Specialised Technical Programs),
- b) Management Information Systems (Supply and Transport, Logistics),
- c) Company Accounting,
- d) International Order Entry and Invoicing (for products moved between countries),
- e) Refinery Management and Production,
- f) Stock Control,
- g) Marketing Systems (these are national),
- h) Financial Reporting.

G emphasise that they do not use international data transmission for data relating to personnel, payroll or credit, nor do they intend to do so.

4)

Security and Privacy

G's data security measures at the moment are largely based on standard computer manufacturer's software. However, a special Study Group on Security has recently been set up and expects to have its own security system shortly.

G are concerned about the impact of impending privacy laws. It is increasingly difficult, G states, to make each of their locations self sufficient with regard to computer resources, and there are already sufficient obstacles to be overcome with PTT tariffs

and policies. G are very concerned about being able to continue to provide their integrated private network on which facilities are shared for data, voice and telegraph applications.

5) Traffic Types

As mentioned, G network circuits are used for both voice and data communication. Their lines to the US are used for data communication to about one-third of the capacity available. Links in Europe are used about 10% for data transmission. The proportion of interactive work to batch processing is 20% to 80% approximately.

To give an idea of the use of the message switching system, the character input per day in the European centre is about three and a half million (many multi-address messages) and, in the main US centre, about five million.

6) Financial Aspects

G's total communications cost for Europe for the last year was 21 million US\$ which includes staff costs. An estimated 50% of this figure is PTT related costs.

In 1974 worldwide telecommunications costs of G amounted to 70 million US\$. More recent figures were not available but G believe that this figure has since then increased by about 30%.

At present their internal charging structure depends on the number of ports each location has to the network. This is expected to change quite soon when a charge per usage will be introduced for the European network. The US Region already operates its part of the network on that basis.

G might consider using a public network if tariffs and conditions are favourable. They believe, however, that PTTs have reacted too late to the demand for data transmission so that organisations such as theirs have had no alternative but to set up their own networks. G see the possible introduction of volume sensitive tariffs as a danger and another example of how the PTTs exploit their monopoly; they believe that PTTs have a misconception about what organisations like G use their private networks for

and that tariffs are becoming restrictive.
International data communications makes economic
sense and anything that would restrict it would be
detrimental to everybody involved, including the
PTTs.

Summary - Organisation H

NETWORK OPERATOR

H is a multinational, US centred, manufacturer of chemical products.

USERS

Network access is available to any operator from a subsidiary of H.

APPLICATIONS

The applications supported by the network include financial and marketing statistics, orders, invoicing, stock control, client indices and payroll.

FUTURE DEVELOPMENT

Immediate plans for the network include higher speeds (9600 bps) for some links and the set-up of another European location.

PRINCIPAL CHARACTERISTICS

The network uses computer centres in two European and one US locations. The European hosts connect nine countries via telephone lines operating mostly at 4800 bps, whilst an AVD circuit links the European HQ to the USA. About 20 terminals use the system, which is batch-oriented.

HETEROGENEITY

Equipment in general is all of the same make. Network access is also possible by telex or the PSTN.

SECURITY OF SERVICE

Verbal communication is required before transmission occurs, and access is further restricted by means of different jobs control languages. There are no automatic security controls.

COSTS

The average monthly cost for each line and for the proportion of data use only is \$20,000.

Appendix A8

ORGANISATION H

1) Introduction

H is a multinational, US centred, manufacturer of chemical products.

The European operations are co-ordinated by European headquarters (HQ). The only information the European HQ have to give the US office is financial information such as budgets and financial results, i.e. H Europe is operationally independent.

The reasons for setting up the H communications network were to achieve a better control of European operations and to rationalise computer use. The same program packages are used in all the European Centres linked by the network. To H this means that there is less need for re-inventing systems.

The present network with host computers in two European location was set up in 1974; the idea was then over 10 years old. In 1970 the first common European program packages were used, each centre using its own computer. Centralisation was started in 1973/74.

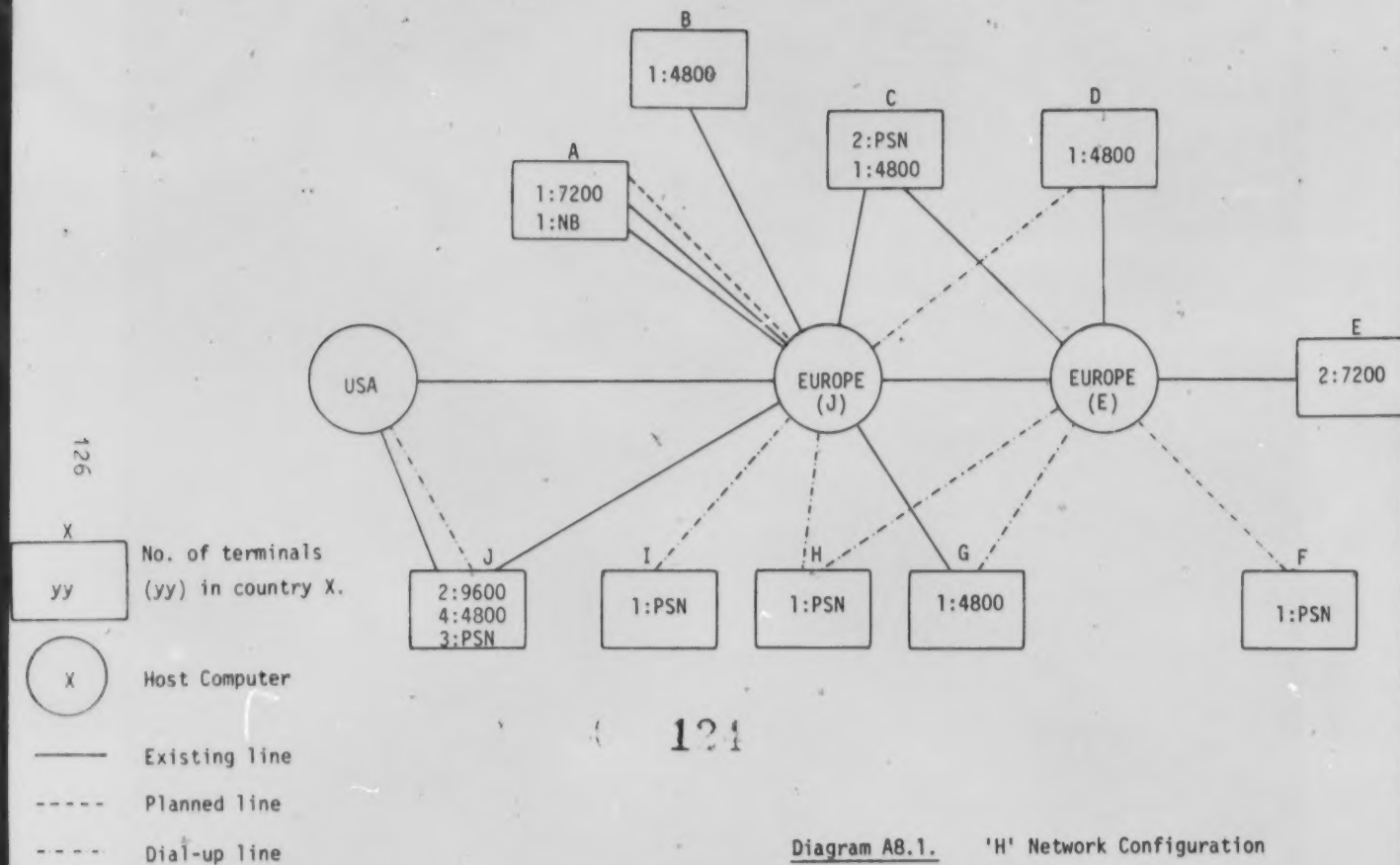
2) Configuration of the Network

Both machine centres use two computers; equipment in general is all of the same make. Diagram A8.1 shows the distribution of terminals and lines.

The network uses telephone lines operating mostly at 4800 bps. It is also used for telephone and telex traffic. An AVD circuit links HQ to the USA. A message switch at HQ is connected to a switch in the USA which permits 4 or 5 telegraph channels to be put on the AVD Line.

There is no automatic answering equipment in the Data Centres; a call is picked up manually and answered - the system is not on-line but batch oriented.

HQ has access to two computers in the USA, via 6 terminals, 4 operating at 4800 bps, and 2 at 9600 bps. The PSTN is also used via 3 terminals.



Immediate plans for the network included the introduction of higher speeds (9600 bps) for some links and the set-up of another European location.

3) Applications

The applications supported by the two network hosts are of four types:

- Financial Statistics; Consolidation of Financial Statements (done only by the HQ centre),
- Marketing Analysis and Statistics,
- Orders, Invoicing, Product Inventories, Stock Control, Client Indices,
- Payroll.

The difference between the two centres is that they handle different departments and that somewhat different statistics are compiled in the two centres; the consolidation of statistics is done at HQ. However, both centres use largely the same programs.

All locations can access all applications except for Payroll, as this does not use standard European systems, but local systems. For example one location does not do its payroll using either of the two centres but uses a local bureau instead. Other locations can use either of the two computer centres.

Examples of the contents of the data files:

- Client Index: . Name
 . Address
 . Products bought
 . Credit Information including credit limit
 . Type of payment
 (may be different according to product).

Each location has its own client index and cannot access other locations' client files unless authorised by HQ. Client files are updated by an order clerk who uses his discretion but would leave the file for about five years after the client has last bought H products.

- Product Master File (Stock Control)

- . Product code
- . Description
- . Stock Control Information
- . Expiry date and information on deterioration
- . Security information
- . Where produced and stocked

- Payroll:

Each centre has its own file. Information includes salary and personnel records, but is variable from location to location. Files are regularly updated and purged and only active employees are kept on the list. If an employee transfers from one H location to another his file is also transferred.

4) Security and Privacy

Any operator from an H subsidiary has access to the network and his own subsidiary's files.

Controls to restrict access are manual, as verbal communication is required before transmission can take place. Further security is given by different job control languages. There are no automatic security controls.

H believe that international privacy laws would affect their network badly. Centralisation would be jeopardised and a regression to the previous system seems likely if the law is too restrictive. Distributed processing may, however, be an acceptable solution.

5) Traffic Types

Data traffic accounts for about 20% of the traffic on leased circuits and is 100% batch processing. Two of the locations accessing the hosts use the network for 20 hours a day on average. Other centres use it for 5-10 hours a day. Those locations with connection to the computer centres via the PSTN use them for less than one hour per day.

6)

Financial Aspects

The average monthly cost for each line and for the proportion of data use only is US\$ 20,000.

H believe that volume sensitive PTT line tariffs could be very detrimental for their business but they have been reassured by their own PTT that for the time being the basis for private line tariffs will not change. H would consider using a public network if conditions and tariffs are advantageous. Private leased lines are used now because they are cheaper and more convenient than public networks.

Each individual location using the network is charged according to its CPU usage. This charge is distributed across the network, so that a location situated further from the data centres is not penalised.

Summary - Organisation I

NETWORK OPERATOR

I is a large bank operating an extensive national communication network and one international line to the USA.

USERS

The network is used by subsidiaries and the Head Office of bank I.

APPLICATIONS

As a general purpose bank I's applications include all normal banking and financial transactions.

FUTURE DEVELOPMENTS

Vague plans exist to include a further line to one overseas location but not details are available at this stage. I is interested in the future international public data networks when an adequate service can be provided.

PRINCIPAL CHARACTERISTICS

Of the dozen or so host computers used in the country where I mainly operates, only one is used for international transactions. A PSTN Link from another country is used for data traffic only and transmits at 2400 bps. There is also a multiple use AVD line to the USA, over which data is transmitted at 4800 bps. Batch processing accounts for all data traffic.

HETEROGENEITY

Equipment in general is all of the same make.

SECURITY OF SERVICE

I applies a series of security measures to prevent theft or destruction of data. Decentralisation offers further security since each centre can only retrieve its own data.

COSTS

Yearly rental of the line to the USA is approximately \$150,000.

Appendix A9

ORGANISATION I

1) Introduction

I is a large bank operating an extensive national communication network and since 1972 one international line to the USA. Vague plans exist to include a further line to one overseas location but no concrete details are available at this stage. A major problem for a bank setting up international links is that banking laws differ in different countries for which reason certain programs cannot serve all countries. For example the law in some countries requires that balances of accounts are not sent outside their country of origin. The bank would consider using an international public data network when an adequate service is offered.

The network is only used by subsidiaries and the head office of the bank.

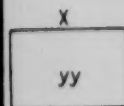
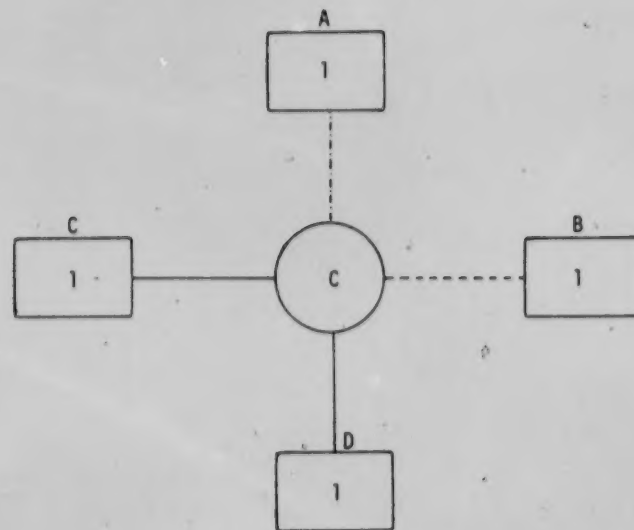
2) Configuration of the Network

The configuration of the network is shown in Diagram A9.1. The line to the USA is a multiple use AVD line over which data is transmitted at 4800 bps. A PSTN link from another country used since 1975 for data traffic only, transmits at 2400 bps. Of the dozen or so host computers used in the country where I mainly operates, only one is used for international transactions. Equipment is in general all of the same make.

3) Applications

As a general purpose bank I's applications include all normal banking and financial transactions, such as:

- Local Currency Accounting
- Foreign Currency Accounting
- Deposit Accounting
- Stock and Share Business
- Payments and Settlements
- Internal Accounting.



No. of terminals (yy)
in country X.



Host Computer



Existing line



Planned line



Dial-up line

130

Diagram A9.1. 'I' Network Configuration

The System also holds customer files. Per client, 200-300 fields are available for storing data but a client can, of course, have any number of accounts.

All data on file stems from only two sources: that information obtained from the client when opening the account and that accumulated through the course of business. Information on this file is given to third parties by order of the customer or where there is a legal requirement. As a founder member, the organisation started to make use of SWIFT; hence all SWIFT applications (q.v.) are relevant.

4) Security and Privacy

I applies a series of security measures which they believe are also relevant to privacy requirements.

Firstly, they have what is called the "Three Generation Principle" by which any data lost through disaster, theft etc., can be reconstructed from three different places. This provides security against destruction.

Security against theft is also provided by strict access restrictions. All people allowed in the computer room must wear an identity badge with their photograph, and the computer centres are always locked. A register on a computer holds information about who used which computer centre at what times. Strict regulations govern the removal of magnetic tapes from the locked archives.

The organisation also believes that the technical difficulties of tapping a line are immense and costly.

Decentralisation offers further security. Each centre can only retrieve its own data, and there is not a single person who knows all the systems fully.

Their main worry about privacy regulation is the extra administrative burden and cost which are involved in the case of organisations like theirs, whose business and clients require them to process personal data.

5)

Traffic Types

Batch processing accounts for 100% of all data traffic. The AVD line to the USA is used for data transmission for about three hours out of a total of 11 hours usage a day. The international dial-up line is used about one hour per day. International data traffic accounts for less than 1% of total traffic.

6)

Financial Aspects

Yearly rental of the leased line to the USA is roughly US\$ 150,000.

I's reaction to volume sensitive tariffs is positive rather than negative, as their line is not used very much. The main reason for having a leased circuit is higher speed, not volume of data. Therefore I feel that they might even benefit from volume sensitive charges, depending of course on the level of these charges.

Summary - Organisation J

NETWORK OPERATOR

J is an international organisation which sells package holidays.

USERS

With the exception of 4 travel agents, all users are staff in sales offices or holiday locations in various countries.

APPLICATIONS

The central host supports the four main applications of reservations, accounting, budgets and prospects, though only the first two are used internationally.

FUTURE DEVELOPMENT

No plans for future development of the network were available.

PRINCIPAL CHARACTERISTICS

The network is based on a central host in a European country from which leased lines extend to four other European countries and to the USA. Most lines transmit at a speed of 2400 bps with one operating at 4800 bps and another at 600 bps (due to be 1200 bps). The line to the USA is linked to a concentrator which connects various offices. All international traffic is interactive and nearly 300 terminals are connected to the network.

HETEROGENEITY

All access to the central host is via terminals, which are of various types.

SECURITY OF SERVICE

Access is only possible for a terminal connected to the leased lines, each terminal being identifiable to the host and having authority to use particular applications only. J intend to introduce a second level of access control involving user identification.

COSTS

J could not give the cost of operating their network, but it is equivalent to the cost of the lines and equipment, which is estimated to be about \$300,000 p.a.

Appendix A10

ORGANISATION J

1) Introduction

J is an organisation which sells package holidays. It is a very international organisation offering holidays in many countries and has sales offices in many others.

Originally J used to allocate "blocks of reservations" to sales offices but this was unsatisfactory and proved to be expensive in international telephone calls in order to make best use of reservations. As a result, in 1971 they developed an on-line reservation system and installed the first international data line.

The network is owned, managed and operated by J and so development is an internal matter.

2) Configuration of the Network

The network is now based on a central host in a European country from which a network fans out as shown in Diagram A10.1.

Most of the lines have data signalling rates of 2400 bps, one is 4800 bps and another 600 bps (due to be 1200).

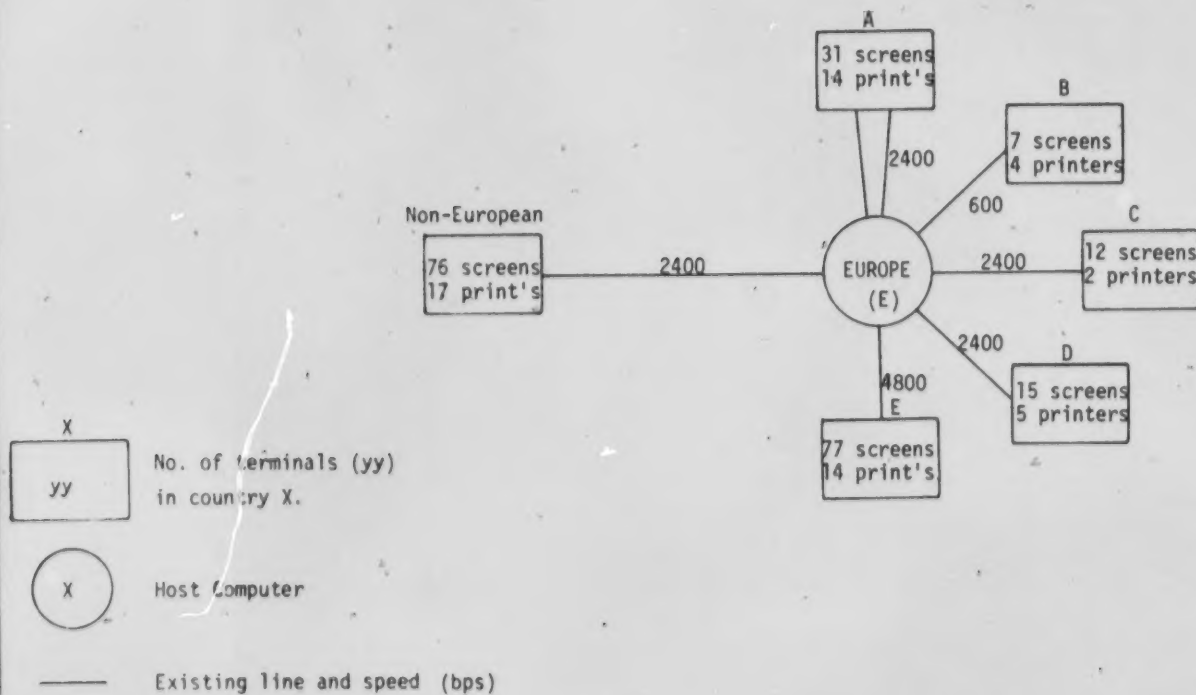
One of the lines goes to the US where it is linked to a concentrator and connects various offices.

Access to the central host is via terminals connected directly to the leased lines. Terminals are of various types.

3) Applications

The central host supports four main applications

- 1) Reservations
- 2) Accounting
- 3) Budgets
- 4) Prospects



Only the first two are used internationally.

The Reservations Application uses two files. Firstly a "Products" file, which details what holidays are offered: packages, travel and locations. Secondly a "Stock" file which describes what is available and what is sold.

With the exception of 4 terminals, all users of the network are staff in sales offices or holiday locations in various countries. The four exceptions are travel agents; however the terminals and lines belong to J and there are no plans for bringing more agents onto the system.

4)

Security and Privacy

Access to the network is only possible for a terminal connected to the leased lines. Each terminal is identifiable to the host and has authority to use particular applications only.

However, they intend to introduce a second level of access control. Each user will have a user identifier and this will allow authority for reading a file or writing to a file, etc., still remembering that the terminal itself can only access particular applications.

J are considering setting up a Personnel File but they are not unduly concerned about privacy legislation because if they only store the following items;

Name of Employee
Date of birth
Social Security Number
Salary
Employee's work record within the Company,

then it will be acceptable to both them and the State. If the foreign offices also use the system they will have to look at foreign legislation when it arises but they do not worry about it.

5)

Traffic Types

International traffic is all interactive. It is difficult to estimate total volume figures; furthermore traffic is very seasonal due to the nature of their business. Other sources indicate that in 1974 traffic volume was about 12×10^6 characters/day.

6)

Financial Aspects

J could not give the cost of operating their network, but it is equivalent to the cost of the lines and equipment. From the network configuration and Logica's TARIFICA Survey, we estimate the annual leased line costs to be US\$ 300,000.

The reason for using an international data network is clearly because it is the best way to handle reservations both efficiently and at a reasonable price.

Since there is no alternative available to them, they use a private network. However, if a public network covering the same areas and fulfilling all their other needs were available, then they would give it serious thought. In particular they would be interested in any service which has volume sensitive tariffs because their network is designed for peak traffic and is under-utilized the remainder of the time.

Summary - Organisation K

NETWORK OPERATOR

K is a large oil company whose operations extend worldwide.

USERS

The network is used internally by various departments of K.

APPLICATIONS

The host computer in the headquarters country supports the three main applications of production and distribution, finance and management, and payroll.

FUTURE DEVELOPMENTS

K aim to integrate the three European networks into one, centred on the European HQ.

PRINCIPAL CHARACTERISTICS

At present the European network is based on three computer centres, one of which is in the headquarters country. Each centre is itself the centre of a star-shaped network with access via leased lines and dial-up connections. HQ also has connection via leased facilities to the USA. Traffic is 100% batch processing.

HETEROGENEITY

Equipment is mainly of one type. Access to the network is also possible to a limited extent via telex.

SECURITY OF SERVICE

Security is provided for by means of restricted access and physical security of computer centres.

COSTS

The annual cost of operating the network, excluding staff costs amounts to roughly \$250,000.

Appendix All

ORGANISATION K

1) Introduction

K is a large oil company whose operations extend worldwide. Its present European network is managed by a special division of the European Headquarters. The network started operating in 1972/73 with, initially, only one line between the USA and European Headquarters.

2) Configuration of the Network

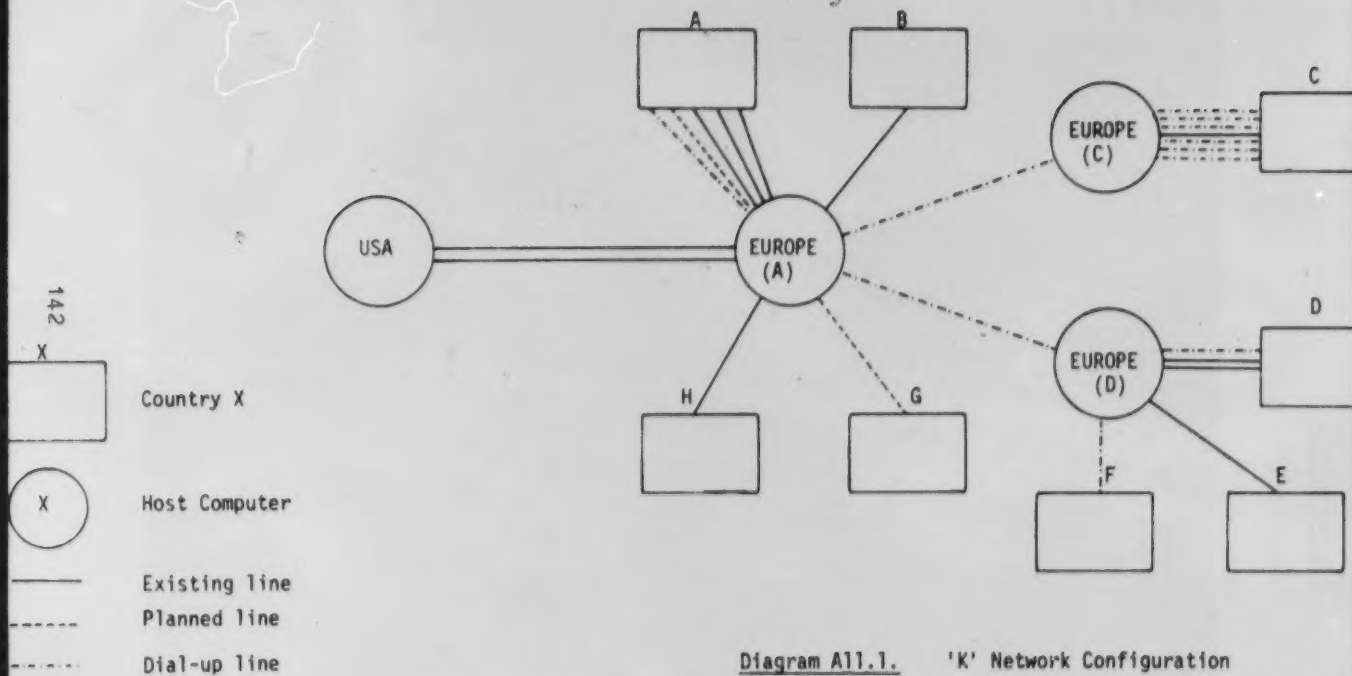
At present the European network is based on three centres, one of them being in the country where Headquarters is located. Each of these three centres is itself the centre of a star-shaped network with access via leased lines and dial-up. The centres are linked between themselves by means of dial-up connections. Only Headquarters has connection via leased facilities to the USA.

The short-term aim is to integrate the three European networks into one, centred on the European Headquarters. Marketing and Refinery companies will still have their own local processing facilities but many applications will be centralised, as the present configuration is unsatisfactory from the point of view of resource sharing.

3) Applications

The following applications are those supported by the host computer in the headquarters country:

- Billing
- Input Ledger
- Bulk Plant
- Sales
- Central Billing
- Credit tickets
- General Information (list of customers in HQ country only)
- Operations (Computers)
- Operational Research
- Work Order
- Trucks
- Ships Inventory
- Wholesale



- Stores
- Primary Input
- Payables (Customer Information)
- Payroll (local by HQ country).

In summary these can be classified into the following categories:

- Production and Distribution
- Financial and Management
- Payroll (local).

Headquarters receives financial information from European countries, which is consolidated and sent to US World Headquarters monthly.

Payroll is done locally in each country, either by using their own DP facilities or a local timesharing bureau. The exception are seamen, whose payroll is processed in the USA.

The US host computers are used for commercial and scientific applications (Chemicals, Models, Linear Programming, Management Reports). Using them involves operator intervention and has proved unsatisfactory, therefore it is intended to move these applications to the European Headquarters when the centralisation discussed in the preceding section is implemented.

Security and Privacy

Access is restricted by sign-on codes as well as manual control (need for verbal communication). Special cards need to be worn to enter computer rooms and lock numbers give further security.

K have found problems concerning privacy in some of the countries where they have locations, even those where there is not yet a 'Privacy Law', which is why processing of payroll is done locally and the future more centralised configuration of the network provides for local processing to cope with such legislation.

Traffic Types

Traffic is 100% batch processing.

Originally one of the transatlantic lines from Headquarters to the USA was used for both voice

and data traffic, but now the whole network is only used for data, and to a very small extent, for telex traffic to the USA on a back-up line. The main transatlantic line is used for data transmission for 24 hours/day, while the lines in Europe are used all the time during working hours (8-12 hours per day).

6) Financial Aspects

The annual cost of operating the network, excluding staff costs, amounts to roughly US\$ 250,000.

Locations using the network are charged for each resource at a different level (i.e. for CPU, print pages, overheads, etc.), calculated by first establishing the yearly amount that should be contributed to the total network costs by the location and then splitting up the cost according to the cost units mentioned.

Summary - Organisation L

NETWORK OPERATOR

L is a large multinational manufacturing company, with Headquarters in the USA.

USERS

The network is used internally by L staff.

APPLICATIONS

Applications relate mainly to production and distribution.

FUTURE DEVELOPMENTS

No information was available about future developments.

PRINCIPAL CHARACTERISTICS

The European part of their network is star shaped and centred in a European country, connected via M102 quality lines to over a dozen European locations and to a host computer in the USA. All international lines transmit at 4800/9600 bps. The network uses a type of data switching, and data traffic is either interactive or bulk data transfer.

HETEROGENEITY

The network is oriented to one equipment manufacturer. Access is also possible via telex channels derived from the international lines.

SECURITY OF SERVICE

Unauthorised access is prevented by means of user identification, passwords and cryptographic data. Each user can only access particular applications and his password serves as an access control both to the network and to the application.

COSTS

The annual line rental costs for the L European network amounts to about \$700,000.

Appendix A12

ORGANISATION L

1)

Introduction

L is a large multinational manufacturing company, with Headquarters in the USA.

The European part of their network is star shaped and centred in a European country. The European sector of the network co-ordinates with other sectors of the World in matters relating to data traffic. Within many countries a national network also operates.

Most countries have national headquarters and many have manufacturing plants or laboratories, which often means that they have their own DP Centres. However, for certain international applications an international data network was required. It began operating in 1969.

2)

Configuration of the Network

Diagram A12.1 shows the configuration of the network. All international lines are of M102 quality, capable of transmitting at 4800/9600 bps. The network uses a type of data switching, although it is not packet switching.

The hosts supporting international applications are located in one European country and the USA. Terminal access is on-line and usually at 7200 bps. Host computers and terminals are of the same make.

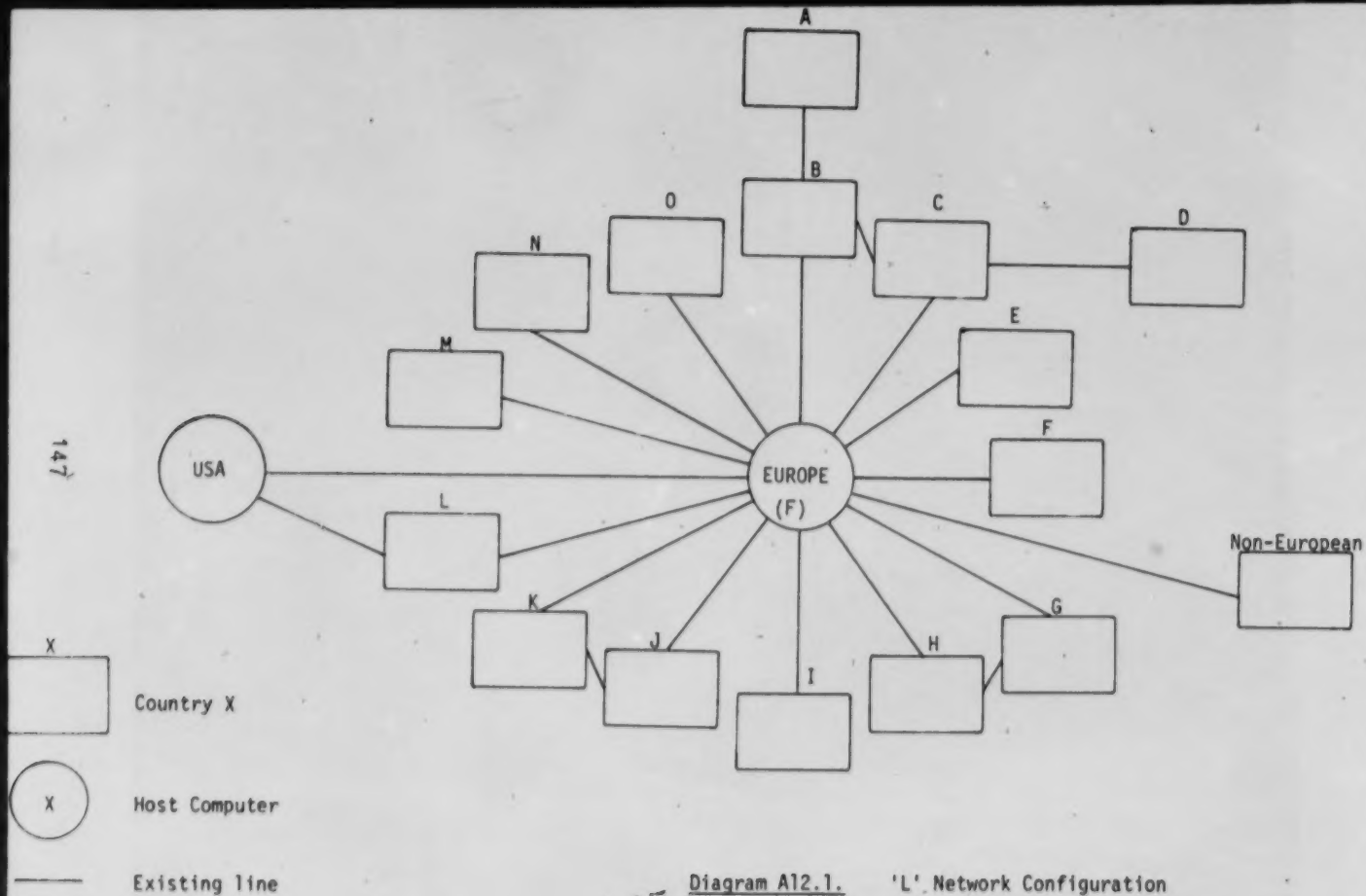
A message switching service uses the same network, i.e. telex channels are derived from the international lines.

The network is not used for voice traffic except for maintenance purposes.

3)

Applications

The international applications supported by host computers accessed by European locations are the following:



145 Diagram A12.1. 'L' Network Configuration

- Maintenance Database
- Systems Engineering
- Order Entry and Stock Control
- Costing
- Instructions
- Bulk Data Transfer.

The applications relate to production and distribution in the main, but the Maintenance Database and the Costing System consist of company confidential information, i.e. "Sensitive Data" as far as the organisation is concerned.

4) Security and Privacy

L use multiple routing and automatic load balancing to improve the availability and performance of private circuits. Security against disaster is provided by the ability to restructure the network centre at very short notice.

To protect the network against unauthorised access various security measures are used: user identification, password and cryptographic data. Each user can only access certain particular applications and his password is used as access control both to the network and to the application.

5) Traffic Types

Data traffic is either interactive or bulk data transfer. The percentage of total calls and traffic and the volume per year is as follows:

	% of calls	% of traffic	Traffic Volume/Year (characters)
Interactive Work	100%	40%	29 x 10 ⁹
Bulk Data Transfer	0%	60%	43 x 10 ⁹

6) Financial Aspects

The annual line rental costs for the L European network amounts to about US\$ 700,000.

L have an internal charging structure for use of the network, a unitary price is charged for every service to each country.

Summary - Organisation M

NETWORK OPERATOR

M is a subsidiary of a US time sharing bureau, and is made up of several companies operating in four European countries, with licences for operating in other countries.

USERS

Anybody who signs a contract with the M service bureau is allowed to access the network. The majority of users are local clients requiring timesharing services.

APPLICATIONS

Many users program their own applications, although M does offer major packages used for management applications such as financial planning, marketing analysis, and production analysis.

FUTURE DEVELOPMENTS

It is intended to expand the international service of the network by marketing harder in countries where M operate and also extend to new countries.

PRINCIPAL CHARACTERISTICS

There is one host computer in Europe and two in the USA. Six European countries are connected via 4800 bps lines, with the transatlantic link transmitting at 9600 bps. Well over 350 terminals use the network, and all data traffic is interactive.

HETEROGENEITY

All terminals in Europe are 300 baud, asynchronous, of all makes. Users access the network via the PSTN.

SECURITY OF SERVICE

User created applications and databases can be heavily protected by changing the password frequently. Access may also be restricted and different access authority provided by means of all kinds of keys and sub-keys.

COSTS

No figures were available for the cost of implementing or operating the network.

Appendix A13

ORGANISATION M

1) Introduction

M is a subsidiary of a US time sharing bureau. The M service bureau is made up of several companies in various European countries and the USA.

The network first began carrying traffic in 1972 and is currently operating in four European countries and also has a licence for operating in other countries.

It is intended to expand the international service of the network by marketing harder in countries where M operates and introducing the service into new countries.

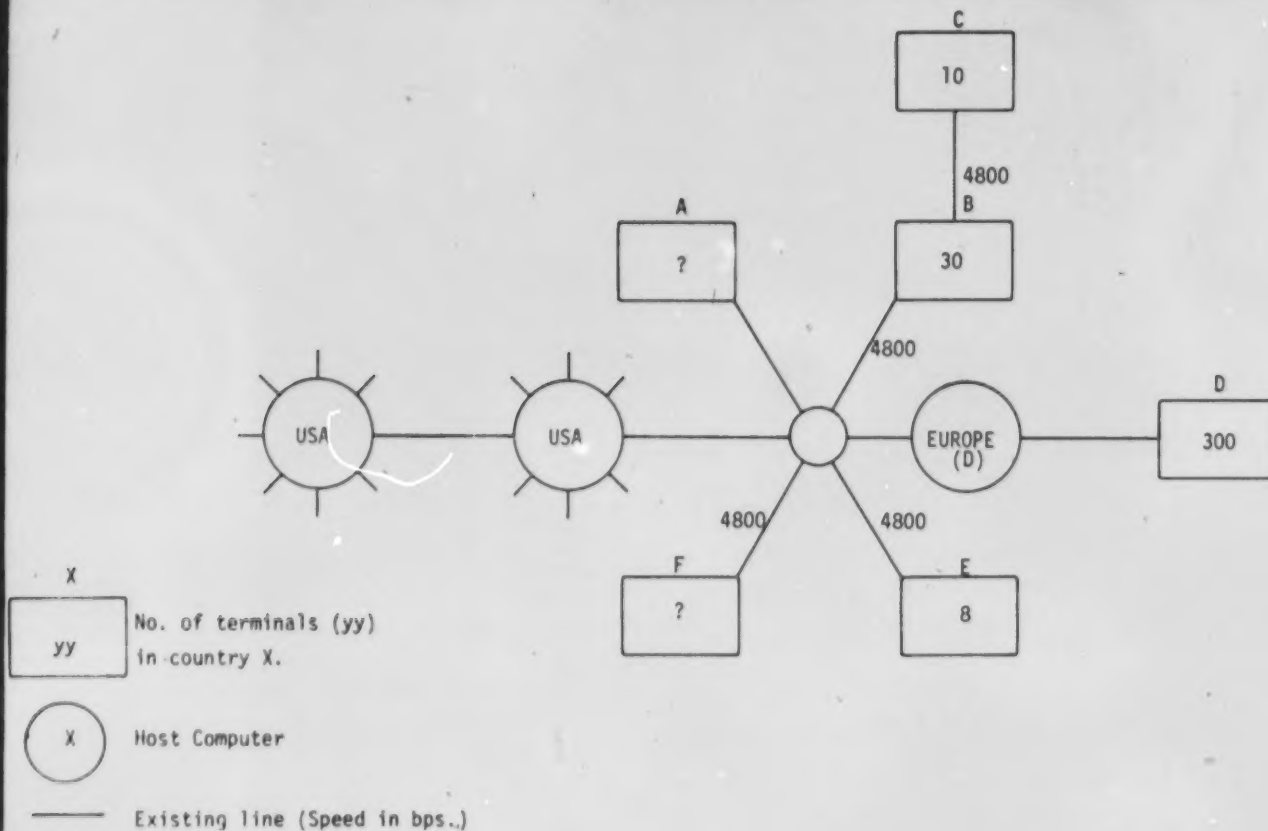
2) Configuration of the Network

A map of the network configuration is shown in Diagram A13.1. The lines in Europe are 4800 bps, and the transatlantic links 9600 bps.

There is one host computer in Europe and two in the USA. All terminals in Europe are 300 baud asynchronous, of all makes. The host computer in Europe is only accessed by terminals in the country where it is located. The rest of the users, including some in that country, use the US hosts.

3) Applications

M offer a timesharing service and therefore users are basically free to do what they will with the machine. Traditionally, their users were FORTRAN users programming their own applications. Now M offer Database Management Tools as their prime service. They offer several major packages, used for management applications such as Financial Planning, Marketing Analysis and Production Analysis. There tends to be little use of "static" systems such as Payroll and Personnel. However, one important point made by M was that although they get involved in developing user systems, they prefer to know as little as possible about the data and applications. This protects them in case of information leaking outside a company.



Security and Privacy

Access is available as usual via the PSTN. A user accessing on M node logs in using his identification number. The 'supervisor' routes him automatically to the host he uses. One interesting point is related to users in the country where the European host is located. When a new user wants to access the bureau, he is allocated either to the European or the US host. However, at any stage M may decide to switch him to a different computer. To the user this switch makes little difference, as his files are also transferred, and apart from the fact that the initial computer-terminal dialogue states the hosts location, the user would not know of the switch.

The user created applications and databases can be quite heavily protected. First, there is the user identity and password. M recommend changing the password monthly, though some users have used the same passwords for years.

In addition the user can protect his data and programs with all kinds of keys and sub-keys to restrict access not only by outside users but to provide for different access authority for internal users, e.g. read but not write authority.

They feel so confident about their security that, provided users follow their recommendations, they will give financial guarantees of security of data.

M have not considered the impending privacy laws at all, but on discussion they feel it would be unreasonable for them to take responsibility for the use clients make of their network. As has already been stated, they prefer to know as little as possible about their users' applications. If they were in any way responsible for complying with data protection laws they would have an enormous burden put upon them in monitoring the applications.

5)

Traffic Types

All the traffic is interactive. The volume of transatlantic traffic generated by M's customers is (very approximately) 5 million characters per day.

6)

Financial Aspects

M have a philosophy of charging users the same irrespective of location. Therefore they have no direct charge to cover the cost of running the network. In fact, since European users access the US machine outside prime shift for the majority of the time, the machine cost plus network cost is approximately equal to prime shift costs on the European machine.

As far as using the new public data networks is concerned, M will use any service that meets their requirements.

Summary - Organisation N

NETWORK OPERATORS

N is part of a large industrial group and was established in 1964 as the group's data processing centre. In 1967 N began selling DP facilities commercially.

USERS

The users are mainly medium and large companies requiring data processing facilities/packages or a network.

APPLICATIONS

N offer packages for applications such as marketing, financial systems, production and stock control, and personnel.

FUTURE DEVELOPMENT

No details about network development were available.

PRINCIPAL CHARACTERISTICS

Concentrators in five European locations are connected via 9600 or 4800 bps lines to the two central computers. Most of the concentrators form part of the public bureau network but some are private and part of the Group. The network supports timesharing, order entry and batch processing jobs. Terminals access the network either over the PSTN or by point-to-point links, and number approximately 250.

HETEROGENEITY

Asynchronous terminals are teletype and of all types and makes, operating at speeds up to 300 baud. The synchronous terminals all conform to one manufacturer's make.

SECURITY OF SERVICE

Security measures include user identification, passwords and data encryption.

COSTS

The operating costs of the network are about \$535,000 p.a.

Appendix A14

ORGANISATION N

- 1) N is part of a very large and diversified industrial Group. In 1964 N was set up as the group's data processing centre and until 1967 it only served the group. In 1967 it began selling data processing facilities commercially. In 1970 it started to operate a network and now operates in 5 countries. In 1977 more than 85% of its work was for customers outside the group.

The operation and management of the network is entirely in the hands of N. For very large investment projects the Group's Board have to give authorisation, otherwise N's management and Board handle decisions.

The bureau services (and network) are available to anybody who wishes to use them, but are mainly used by medium and large companies.

2) Configuration of the Network

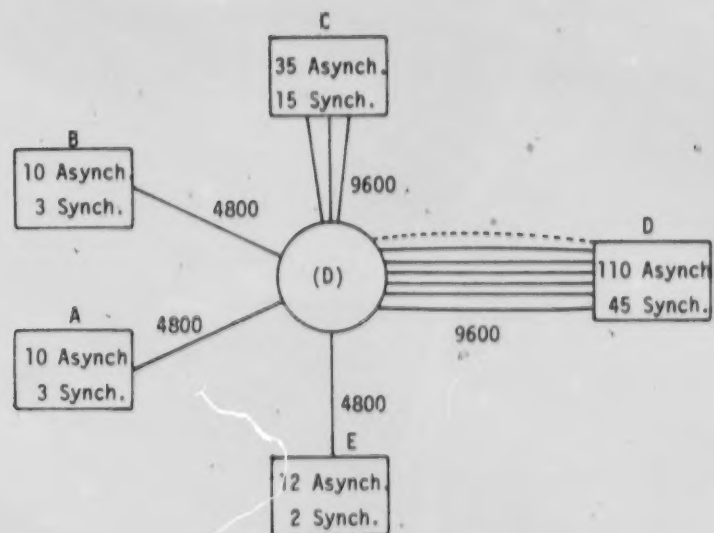
The network is a star-shaped network centred on two computers. From this centre a whole series of lines emanate to the remote concentrators. The lines are either 9600 or 4800 bps. The network configuration is shown in Diagram A14.1. Most of the concentrators form part of the public bureau network but some are private and part of the Group.

The network supports three main types of jobs:

- Timesharing
- Order Entry
- Batch Work.

Terminals can access the network either over the PSTN or by point-to-point links.

The asynchronous terminals are teletype compatible and are of all types and makes, working at speeds of up to 300 baud.



The terminals can either be on the customers premises, and rented from N, or on N's operating companies' premises for customer's RJE. This is particularly useful for timesharing customers who may have bulk input or output requirements.

3) Applications

N offer a "total computing concept", i.e. large processors, wide communications network, applications packages, systems analysis and programming. They also do turnkey mini-computer projects.

N's software falls into five categories:

1)	Personnel	10%
2)	Financial Systems	30%
3)	Production & Stock Control	20%
4)	Marketing	15%
5)	Other	25%.

They have many packages for applications (1) - (4). However, 70% of the timesharing falls into the Financial Systems category.

Another way of looking at their work is as follows:

1)	Absolutely Standard Packages	15%
2)	'Base' Packages with built in flexibility for users	42.5%
3)	Tailor made systems	42.5%.

Thier own brochure outlines the packages offered in the following list:

- 1) Salaries, Wages and General Payroll Accountability
- 2) Economic Planning (Short and Long Range Planning, Forecasting, Budgeting, Investments, Financing, Economic Models etc.)
- 3) Standard Accounting (Book-keeping)
- 4) Cash Flow (Accounts Payable, Receivable, etc)
- 5) Order Processing and Invoicing

- 6) Stock Control
- 7) Control of Materials, Parts and General Production Planning & Control.

On the whole customers require the Data Processing Packages, but there are a few international companies who do need the network facility to centralize their information.

4) Security and Privacy

a) Access Control

At the first level users need to know the telephone number. Then they have to log-in with a user identification and a password. The password is chosen by the user and can be altered regularly.

In addition the user has available to him several levels of security, e.g. locking a file or a program so only certain people can update them or read them etc., which is usual in timesharing. However, the standard manufacturer's software does not give these facilities and N have included user identification and password facilities on their RJE facilities.

b) Data Security

N offer encryption facilities to their customers at three levels:

- 1) data storage
- 2) programs
- 3) data transmission.

Only the first encryption facility is used. This means that only the user has the deciphering key and not even N hold a copy. There have been cases where a user has "lost his key" as a consequence of which all the data is lost for ever!

5) Traffic Types

The proportion of different types of traffic and the corresponding volumes are as follows:

	% of Calls	% of traffic	Traffic volume/ year (characters)
Interactive	60	35	5.2×10^9
Batch Processing)			
Bulk Data)	40	65	9.5×10^9
Transfer)			

6) Financial Aspects

The operating costs of the network are about
US\$ 535,000 per year.

Their reaction to the idea of volume sensitive tariffs for leased lines is that it depends on the level of the tariff! N also feel that they would not benefit from a public data network and intend to carry on using their private network, except for a few locations where a private circuit is not justified.

Summary - Organisation O

NETWORK OPERATOR

O is an international timesharing bureau which started operating in the US in the mid 1960s and later extended their network into Europe.

USERS

The use of O is open to anybody who wishes to be a client. However, the majority of users are banks, financial institutions and government departments.

APPLICATIONS

O aim to offer a specialist timesharing service and their main applications include financial services, planning, government, banking and inventory management.

FUTURE DEVELOPMENT

A second machine centre is planned for Europe and it is also expected that terminals in the USA will eventually be able to access the European computers.

PRINCIPAL CHARACTERISTICS

The network uses multiplexer switching to 4 host computers in a European country and 14 in the USA. All international circuits are of M102 quality and transmit at 4800 bps. Terminals number approximately 400 distributed between four European locations and transmit at 10, 30, 60 and 120 cps (asynchronous).

HETEROGENEITY

The network is oriented to one equipment manufacturer. Terminals access O over the PSTN and traffic is 100% interactive.

SECURITY OF SERVICE

Access to the network and applications is restricted by the use of passwords. Several of O's clients also scramble their data to provide extra protection.

COSTS

The cost of setting-up the European network is quoted as \$850,000 - \$1.25m including hardware. Operating costs were not available.

Appendix A15

ORGANISATION O

1) Introduction

O is an international timesharing bureau which started operating in the United States in the mid 1960s. Their communications network was later extended into Europe. Their European activities are controlled by a holding company owning the European companies. This holding company is autonomous and takes independent decisions concerning the European network, although the parent companies are represented on its Board.

As a timesharing bureau the use of O is open to anybody who wishes to be a client. However, because many of O's applications are specialised, the majority of users are banks, financial institutions and government departments. O actively encourages work in these areas and does not promote a general timesharing service.

2) Configuration of the Network

Diagram A15.1 shows the configuration of the European section of the O network. All international circuits are of M102 quality and transmit at 4800 bps. The network uses multiplexor switching to 4 host computers in a European country and 14 in the USA.

Terminals transmit at 10, 30, 60, 120 cps. (asynchronous) and access O over public switched facilities. At present European terminals can access transatlantic host computers, but not vice versa. This is expected to change and terminals in the USA will eventually also be able to access the European computers. O also plan to have a second machine centre in Europe.

The mainframe computers are mainly of the same make.

3) Applications

O's aim is to offer a specialist timesharing service to clients. They understand their expansion not in terms of international network expansion but in offering specialist services in specific areas.

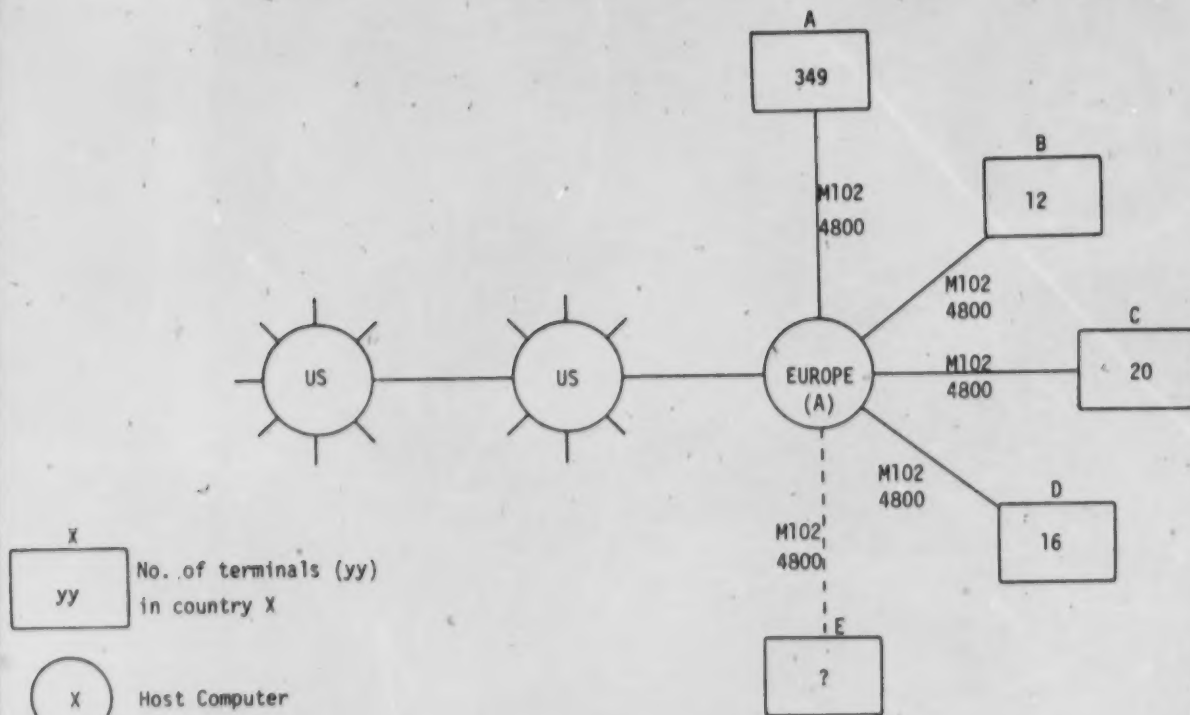


Diagram A15.1.

'O' Network Configuration

Their main applications are the following.

- 1) Financial Services, Planning and Data Management. This is by far the most important, and involves Planning, Data Management, Consolidation of Information for Head Office, etc. This application is available on all computer centres.

Example of user: a European company uses the network for forwarding information to their US Head Office.

- 2) Government.

Used for statistical analysis and data management (anonymous type of information).

Example: Government departments in two other European countries use the European host to process their data.

- 3) Banking.

These include all typical banking applications. Up till now O has specialised in Foreign Exchange Applications but the trend is now to specialise in Bond Markets instead.

- 4) Inventory Management.

Includes all typical stock control applications.

- 5) General Data Management and Interactive Services.

4) Security and Privacy

Access to the network and to specific applications is restricted by the use of passwords. Clients are also free to scramble their data, and several of O's clients, particularly Government Departments, do this to give extra protection to their data. O have only found problems with privacy legislation in the country where they are planning to set up a machine centre. They are however very uncertain about how privacy laws would affect them.

5)

Traffic Types

Traffic is 100% interactive.

6)

Financial Aspects

The cost of setting up the European network is quoted as US\$ 850,000-1,250,000 including hardware. Operating costs and charging structure were not available at the time of writing, but using the US host computers costs the European client slightly more than using the London centre. O are very willing to use public networks for their links if these are available and convenient. They find, however, that information about the proposed data networks, services, tariffs and conditions is not readily available, which hinders their planning.

Summary - Organisation P

NETWORK OPERATOR

P is an international timesharing bureau with its HQ in the USA.

USERS

The network services are available to anyone who wishes to be a client.

APPLICATIONS

The wide range of available applications includes financial planning; reservation systems, project and information management, and econometric databases.

FUTURE DEVELOPMENT

Several extensions to the network are planned, including the siting of another computer centre in the USA, and links to 3 new European locations.

PRINCIPAL CHARACTERISTICS

The network is served by computer centres in Europe and the USA, and uses packet-switching technology. Six European locations are connected to the European host via M102 telephone lines operating at 4800 bps. Interactive work accounts for about 90% of all traffic and there are approximately 200 terminals accessing the European network at present.

HETEROGENEITY

The network is oriented to one equipment manufacturer.

SECURITY OF SERVICE

As many of P's clients are government departments and banks, adequate security has high priority. Passwords and client numbers are used, and clients are free to scramble their data.

COSTS

The cost of running their European network was quoted by P to be \$250,000 p.a.

Appendix A16

ORGANISATION P

1) Introduction

P is an international timesharing bureau with its HQ in the USA. It now has two machine centres serving the network (one in the USA and one in Europe), both centres providing the same services. Eventually it is planned to have three computer centres by including another centre in the USA.

The manager responsible for the European network is free to make decisions on European matters once his business plan is approved.

P's services are available to anyone who wishes to be a client.

2) Configuration of network

Diagram A16.1 shows the configuration of the network. The European network comprises M102 telephone lines with signalling rates of 4800 bps. The network uses packet switching technology and is oriented to one equipment manufacturer.

P plan to extend their network considerably. Their plans include a port into the Telenet network in Canada, and there are definite plans to have links with three new European locations. The possibility of introducing wide-band links is also being considered. Other developments planned include end-to-end acknowledgement of calls and alternate routing.

3) Applications

The number of applications offered by P is considerable. They include (location of host computer supporting each application is given in brackets):

- project management (Europe and USA)
- manufacturing control (Europe)
- time series analysis, statistics and econometric databases (Europe and USA)
- information management (Europe and USA)

X
yy No. of terminals (yy) (all asynchronous) in country X.

X Host Computer

— Existing line

----- Planned line

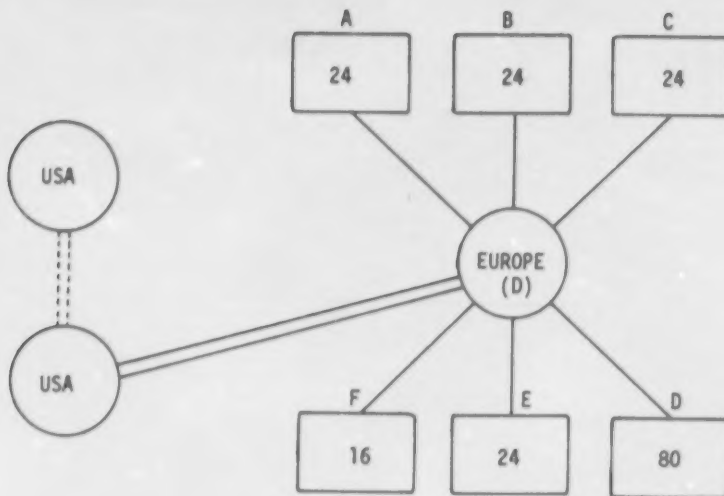


Diagram A16.1. 'P' Network Configuration

- financial planning and corporate planning (Europe and USA)
- budgeting (Europe and USA)
- reservations systems (Europe)
- marketing (Europe).

Being a timesharing bureau the network is available to all kinds of clients. At present 20% of P's timesharing business comes from Government and Public Utilities. Other business comes from banks and financial and commercial institutions. A small percentage of their business is done for the governments of European countries other than that of their HQ. Thus there are Government Departments in other European countries using the P European or US host computer to store and/or process their data, even if only to a small extent. A high percentage (about 80%) of P clients have their own computer. They use P because they need a communication network or because their computers tend not to be sufficiently interactive or because they do not have some of the facilities offered.

4) Security and Privacy

As a large proportion of P's clients are Government Departments, Banks and Financial Institutions, adequate security has high priority to P. Passwords and client numbers are used. Operators only have code numbers and do not know who the client is. Clients can also scramble their data to make it meaningless for outsiders. P believe that their security is very high, and probably higher than on their client's own premises.

P are not overconcerned about the impact of privacy laws on their business since they believe that without question the user of the network should be responsible for complying with such laws.

5) Traffic Types

Interactive work accounts for about 90% of all traffic; batch processing for roughly 10% and bulk data transfer for less than 0.5%.

Financial Aspects

The cost of running their European network was quoted by P to be US\$ 250,000 per annum. This figure refers to PTT related costs (e.g. leased lines, modems, spares, etc.) but excludes depreciation costs.

P are currently making calculations to work out what the impact of volume-sensitive PTT tariffs would be on their business and what tariff levels would be acceptable. Volume-sensitive tariffs may be advantageous when building up a network, as P are in the course of doing, because charges might only be made once the lines are used. With the present tariff structure monthly rentals are payable whether or not a line is used. In general, P are not against the idea of volume-sensitive tariffs.

Their own tariff structure as charged to clients using their services includes a charge for connect time and a resource unit, which is made up of central processing time and other computer resources.

Summary - Organisation Q

NETWORK OPERATOR

Q is primarily a batch processing bureau operating batch centres in three different European countries. One of these centres also offers a timesharing service.

USERS

The Q network is available to anyone who wishes to be a client.

APPLICATIONS

The international applications are engineering and construction, statistics, market research and financial planning.

FUTURE DEVELOPMENT

No information about future development was available.

PRINCIPAL CHARACTERISTICS

Q use a switched network, with two international circuits of M102 quality to European countries. The lines transmit data at a speed of 4800 bps and carry timesharing traffic only as the centres are mainly concerned with batchwork.

HETEROGENEITY

Access to the network is available by the PSTN, telex and teletypewriter.

SECURITY OF SERVICE

No details about security measures were available.

COSTS

Detailed operating costs were not available from Q, but annual rental of their international lines is estimated to be about \$80,000.

Appendix A17

ORGANISATION Q

1) Introduction

Q is primarily a batch processing bureau operating batch centres in three different European countries. One of these centres also offers a timesharing service which can also be accessed from the other countries by dialling up to the nearest network node.

2) Configuration of the Network

Q use a switched network. The two international circuits to countries in Europe (see Diagram A17.1) are of M102 quality and transmit at 4800 bps. They only carry timesharing traffic, as each of the centres is mainly oriented to batchwork.

3) Applications

Only applications of the timesharing service are relevant, as it is the only international service.

These applications are mainly:

- Engineering and Construction
- Statistics
- Market Research
- Financial Planning.

4) Security and Privacy

No details about security and privacy aspects were available.

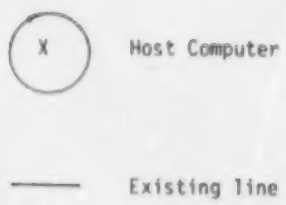
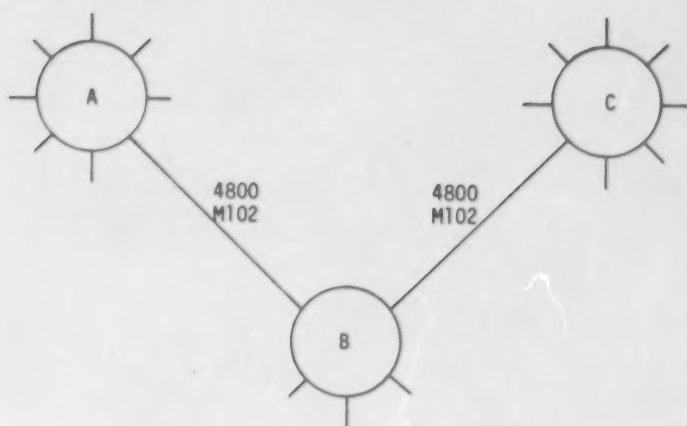


Diagram A17.1 'Q' Network Configuration

5) Traffic Types

The total yearly volumes of different types of traffic are as follows:

Interactive Work	10 ⁷ to 10 ⁹ *	characters
Batch Processing	10 ¹¹ to 10 ¹²	characters
Bulk Data Transfer	Unknown	

*The international volume of interactive work is about one tenth of the total.

6) Financial Aspects

Detailed operating costs were not available from Q. However, based on Logica's TARIFICA, we estimate the annual rental of their international lines to be roughly US\$ 80,000.

Q's reaction to the possibility of usage related tariffs for private circuits is rather negative, as they are concerned about the impact of such tariffs on their business.

Summary - WMO & GTS

NETWORK OPERATOR

WMO (World Meteorological Organisation) operates a telecommunications network called the Global Telecommunications System (GTS).

USERS

Meteorological offices of countries with national centres have access to the network.

APPLICATIONS

The GTS network is used for the international exchange of meteorological information.

FUTURE DEVELOPMENTS

It is planned to introduce higher line signalling rates (eg 4800 bps) and to extend or replace some of the centres.

PRINCIPAL CHARACTERISTICS

An international message switching network consisting of a main trunk circuit from which national and regional circuits branch out. In theory the speeds on the data circuits of the main trunk should be 2400 bps, but in practice some stretches reach only 1200 bps. Alternative links exist between most of the centres, which confers relative invulnerability on the main ring of the network.

HETEROGENEITY

The choice of hardware is left to each national centre, provided they meet ITU standards and WMO requirements.

SECURITY OF SERVICE

There are no particular measures to restrict illegal access as WMO feels that the data is of no interest to anyone unconnected with weather watching.

COSTS

The cost of setting up and operating GTS is obviously large. For example to set up the centres at Bracknell and New Delhi cost \$1.7m and \$1.17m, respectively.

Appendix A18

GTS - THE WORLD METEOROLOGICAL NETWORK

1) Introduction

The telecommunications network of the World Meteorological Organisation (WMO) is called the Global Telecommunication System (GTS). Its primary function is to provide telecommunications facilities for collection, exchange and distribution between National, Regional and World Meteorological Centres of observational data and processed information.

The network consists of a main trunk circuit from which national and regional circuits branch out, as shown in Diagram A18.1.

The main trunk or ring is controlled by the WMO Headquarters in Geneva who issue the corresponding procedures and standards. At the end level there are six continental regions, where the countries within each region agree on regional procedures; different procedures apply again at the national (third) level.

The old WMO network existed on 50 baud lines for many years. The purpose of the present GTS was defined in the World Weather Watch plan approved by the Fifth Congress in 1967 and updated by the Sixth Congress in 1971.

2) Configuration of Network

The circuits are leased from the Telecommunication Administrations and paid for by each national centre, according to the usual rules (half by each country).

In theory, the speeds on the data circuits of the main trunk should be 2400 bps, but in practice some stretches reach only 1200 bps. Data transmission at 2400 bps was implemented between Tokyo and Washington in November 1970, and between Washington - Bracknell - Paris - Offenbach in May 1973. The Eastern sections still operate at 1200 bps and between Melbourne and Tokyo 75 baud lines still operate. It is planned to introduce higher signalling rates (e.g. 4800 bps) and to extend or replace some of the centres.

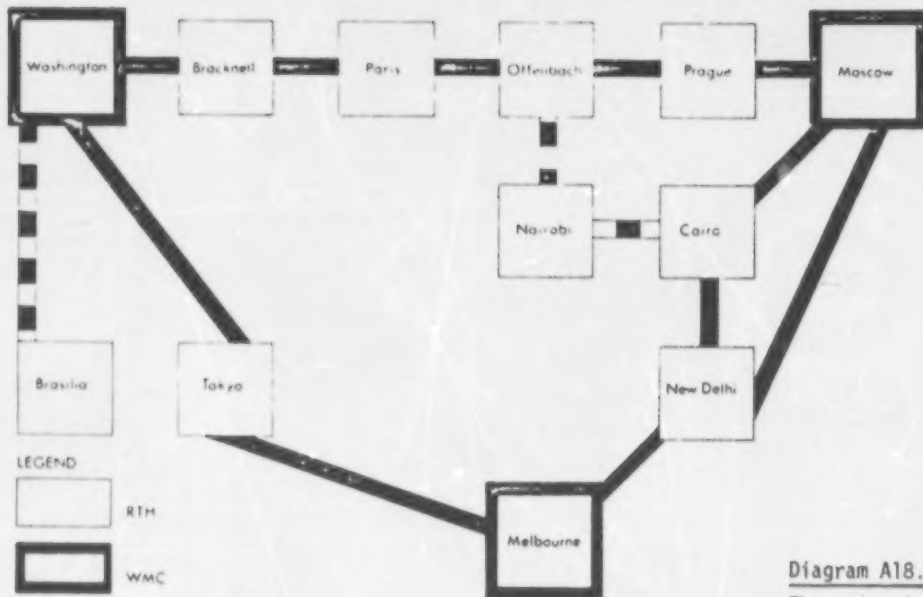


Diagram A18.1

The main ring of the WMO GTS Network

The network is of the message switching type. This means that the data is received by the centre, stored in the mass storage device, edited together with the data the centre has collected itself, and then the entire message is sent to the next centre on the ring. As quite a number of countries wished to be on the main trunk, delays tend to occur although they are minor for digital data.

WMO state that circuits are planned in such a way that the volume of traffic to be passed over any one channel will not exceed 80% of its ultimate capacity.

The choice of hardware is left to each of the particular national centres, as long as they meet ITU standards and WMO requirements.

There are alternative links between most of the centres which confers relative invulnerability to the main ring of the network. For example, if the link Bracknell - Paris - Offenbach is interrupted in Paris, an alternative link Bracknell - Offenbach is available. The exception is the centre at Bracknell the breakdown of which would mean the collapse of the ring, as there is no fall back link between Washington and Bracknell. The lines on the Eastern section are still too slow to permit the transmission of data in the opposite direction (i.e. Washington - Tokyo - Moscow - Paris - Bracknell).

3)

Applications

Meteorological information has a vast number of uses. In the United Kingdom, for example, meteorological data is passed on to the general public, public utilities and private organisations (e.g. Commodity Brokers). Three examples of such organisations quoted by WMO (UK) are the North Sea Oil Exploitation Organisation, who receive information on North Sea weather conditions; Coffee Traders, who receive information on weather conditions in coffee growing areas of the world and a major confectionery manufacturer who receives meteorological data on areas in the world where coconut trees grow!

It is, of course, possible that in the case of war or threat of war, the network ceases to function or that its functioning is severely restricted, as did happen during World War II. In practice, however,

co-operation extends worldwide and meteorological data is transmitted with comparatively little regard to political conflicts. For example during the Pakistan/ India conflict, Karachi kept inputting and receiving data from the New Delhi centre.

Coded messages are used for the international exchange of meteorological information comprising observational data and processed data. Coded messages are also used for the international exchange of observed and processed data required in specific applications of meteorology to various human activities (like flight information) and for exchanges of information related to meteorology.

The codes are composed of a set of code forms made up of symbolic letters (or groups of letters) representing meteorological or, as the case may be, other geographical elements, such as location of the observing station.

Apart from international codes, several sets of regional codes exist which are intended only for exchanges within a given WMO Region. There are also national coding practices.

A meteorological message, or bulletin, consists of 3 parts; a message envelope, an abbreviated heading and the message data.

The amount and variety of meteorological data sent is vast. A small extract of the information that might be contained in a code in a meteorological bulletin is:

- Speed of the current, in cm/s, at sea surface.
- Direction of surface wind
- Force of surface wind
- Dew-point depression at the tropopause level
- Thickness of ice accretion on ships in cm
- Type of data sensing equipment
- Type of isopleth
- Mean vapour pressure for the month, in tenths of a millibar
- Period of time covered by forecast
- Time of observation in hours and minutes GMT
- Altitude of tops of clouds in 100s of metres
- Genus of clouds
- Effect of ice on navigation
- Source region of air mass
- Thermodynamic character of air mass

- No. of days in month with precipitation equal to or greater than 1 mm
- Character of pressure system
- Pressure in terms of millibars, at the maximum level
- Amount of precipitation
- Depth of snow
- Minimum Air Temperature
- Forecast temperature in whole degrees Celsius
- Temperatures, in tenths of a degree Celsius, at sea surface
- Horizontal visibility at surface.

In summary, the information transmitted includes firstly reference to the recording station, its latitude/longitude, day and time of day and meteorological data on such things as pressure, temperature, wind force and type, clouds, precipitation.

4) Security and Privacy

Meteorological offices of countries with National Centres have access to the network. There are no particular measures to restrict illegal access. WMO feels that the type of data transmitted is of no particular interest to anyone unconnected with weather watching.

From the operational point of view it does happen occasionally that data is lost.

5) Traffic Type

All traffic on the network is message switched. As an idea of the volume of data on the main ring the daily traffic through Bracknell is 1,000,000 to 1,500,000 characters. This is the approximate equivalent of 1.5 hours transmission per day at 2400 bps.

6)

Financial Aspects

The cost of setting up and operating GTS is obviously large. Each centre is responsible for acquiring, installing and running its own system, as well as financing its share of the international and national lines that link it to other centres.

As an example we quote the cost of setting up 3 of the centres:

Bracknell :	approx.	US\$ 1,750,000
New Delhi :	"	US\$ 1,175,000
Iceland :	"	US\$ 290,000.

Summary - CERN

NETWORK OPERATOR

CERN, located near Geneva, is the principal high energy physics research centre in Europe. Strictly speaking CERN does not operate a network, but there is a network of data lines centred there.

USERS

The network is used by experimenters in high energy physics research laboratories all over Europe.

APPLICATIONS

Data transmitted internationally is purely scientific, concerned with physics research and experiments.

FUTURE DEVELOPMENT

Lines will shortly be installed to laboratories in Hamburg and Italy. The longer term plans foresee linking all the centres and CERN to Euronet, and it is also intended to have satellite links between CERN and laboratories in England, France and Germany.

PRINCIPAL CHARACTERISTICS

At present the links are point-to-point RJE lines from Geneva to England and France. The Amsterdam line is of dial-up type, whilst the other two operate at 9600 bps and 4800 bps, respectively. Traffic is 100% batch processing.

HETEROGENEITY

Most of the hardware used on the lines is supplied by IBM and CDC.

SECURITY OF SERVICE

Security is provided by the point-to-point links, which limits access to the endpoints.

COSTS

Network costs are equatable to the costs of the leased circuits or international dial-up connection, and are borne by the individual laboratories.

Appendix A19

CERN

1) Introduction

CERN, located near Geneva, is the principal high energy physics research centre in Europe. Groups of experimenters from all over Europe and the world set up experiments which require resources and expertise from many countries. Over 3000 research physicists from over 150 university departments or other research institutes need to co-operate to be able to run their very complex and expensive experiments. The experiments generate immense amounts of data - CERN talks in terms of 20-30 standard computer tapes per experiment.

Analysis of the data takes place at the home laboratories of the experimenters. Some of the European laboratories are the following:

- Rutherford, Oxford, England
- Daresbury, Warrington, England
- Zeeman, Amsterdam, Netherlands
- Saclay, France
- Desy, Hamburg, Germany
- Various Italian centres (Frascati, Padova, Pisa, Bologna).

Each link is owned and operated by the individual laboratories e.g. Rutherford.

The experimenters need to use data communications

- to access programs and data in their home laboratories
- to check the data being produced by the CERN experiment before dismantling them.
- to transfer the bulk data produced by the experiment (At present this is done by freighting magnetic tapes)
- to share data between the laboratories (Experiments are often done in collaboration with other laboratories).

2) Configuration of the Network

Although strictly speaking CERN does not have an international data network, it is the source of a great deal of international data traffic and is planning to increase its facilities.

The present links are the following:

1. RJE/9600 bps line from Geneva to England, split into 4800 bps lines to Rutherford (IBM 360/195) and Daresbury (IBM 360/165). Also CERN internal network linked to Rutherford RJE.
2. RJE/4800 bps line from Geneva to Saclay (France) (CDC 7600).
3. RJE/dial-up link to Amsterdam.

In the short term future the following lines will be installed.

1. RJE to Desy laboratories in Hamburg (IBM 360)
2. RJE to Italy.

The longer term plans foresee linking all the centres and CERN to Euronet for sharing data and accessing programs, which would be particularly beneficial to the smaller laboratories.

It is also intended to have a satellite connection between CERN and Rutherford, CERN and Desy and CERN and Saclay, to permit bulk data transfer at fast rates. However, the recent ill fate of the OTS satellite is likely to affect this plan.

3) Applications

Data transmitted over the international links to the various national laboratories is purely scientific, concerned with physics research and physics experiments.

Experiments need to be set up carefully, are very expensive and are run 24 hours a day.

Experiment preparation tends to involve research physicists from several laboratories, and often several countries. Experimental data is collected in large quantities; some of it is subject to detailed checkings on the spot to ensure it is 'reasonable'. Currently, the data is written onto magnetic tapes by the data collection mini-computers and checked by the CERN mainframes within one hour. This allows the experimental set-up to be adjusted and the experiment to be re-run as soon as possible (known locally as bicycle-on-line). The aim is to use satellite connections to pass the test data to the home laboratory for checking and then transfer the complete data over the satellites. The experiment is due to begin in 1979.

4) Security and Privacy

CERN are naturally not particularly concerned about problems of privacy. Security is given by point to point links which limits access to the endpoints.

5) Traffic Types

Information about types of traffic carried over the point to point links was not available, but it is probably exclusively batch processing.

6) Financial Aspects

The cost of the "network" is equatable to the cost of the leased circuits or international dial-up. As has already been stated these costs are borne by the individual laboratories.

Unfortunately it was not possible to obtain data relating to the usage of the leased circuits to analyse their cost/benefit. However it is felt that EIN and Euronet will meet the needs of the research community in a much better way - not only will usage related tariffs allow access to the smaller laboratories, but a switched network will allow access between the laboratories.

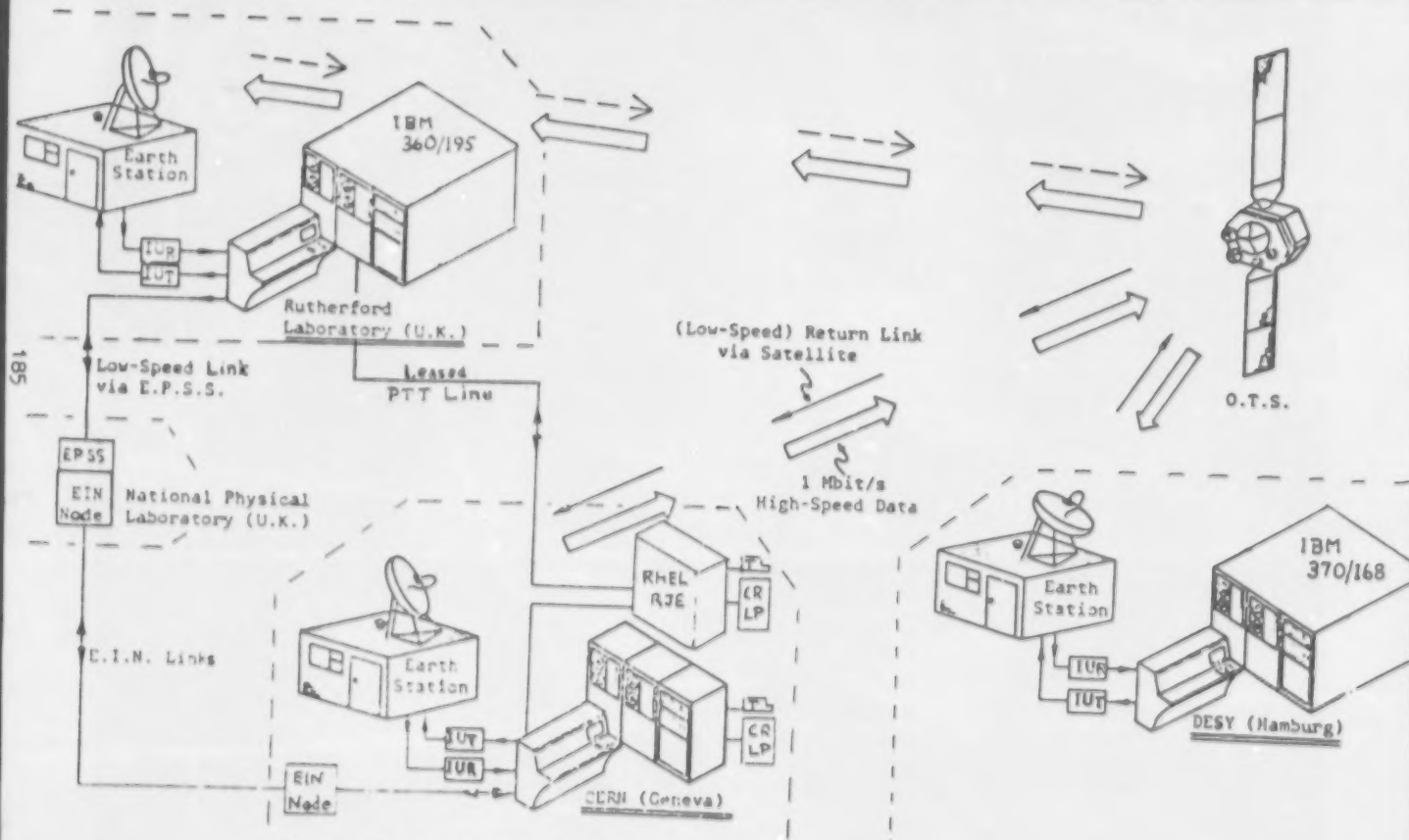


Diagram A19.1 CERN Computer-to Computer Communication Experiment

The EEC have allocated 400,000 accounting units for the CERN satellite experiment but the individual laboratories will have to pay for their part of the equipment.

Summary-EIN

NETWORK OPERATOR

The European Informatics Network (EIN) was set up as a research project by the COST Group (Coopération européenne dans le domaine de la recherche scientifique et technique).

USERS

Any research organisation which applies successfully to its government for network access may use EIN.

APPLICATIONS

Data transmitted internationally relates mostly to research into data-processing over networks.

FUTURE DEVELOPMENTS

The network is likely to be extended by the connection of secondary centres to the existing national nodes. Future plans also include the introduction of virtual terminal and bulk transfer protocols, as well as the development of an X25 interface.

PRINCIPAL CHARACTERISTICS

The network is packet switched, connecting nodes in Italy, France, Switzerland and the UK via leased lines operating at 9600 bps. Traffic is at present either interactive or of message switching type.

HETEROGENEITY

Computer hosts are offered by IBM, Univac and CDC. Access to EIN is also possible via the NPL and CYCLADES networks.

SECURITY OF SERVICE

There is very little concern about security and privacy aspects.

COSTS

The cost of leasing the lines from the PTTs is at present shared equally between the centres, the monthly total being about BF 625,000.

Appendix A20

EIN

1) Introduction

The European Informatics Network (EIN) was set up as a research project (the COST-11 project) by the COST Group (Coopération européenne dans le domaine de la recherche scientifique et technique). It is the eleventh project of the COST Group.

The funding of the network and, indirectly, its ownership involved two levels: countries joining the project are known as signatories and could either be:

- passively involved and receive information on the project
- or
- actively involved and nominate and operate a centre connected to the network.

The original signatories in November 1973 were France, Italy, Norway, Portugal, Sweden, Switzerland, UK, Yugoslavia and Euratom. Since then, Germany and the Netherlands have joined. Of these France, Italy, Switzerland, UK and Euratom operate EIN centres.

These five operators own and operate their centres by nominating an operator, for example the National Physical Laboratory in the UK, IRIA in France.

The COST-11 Agreement, as quoted by the Cost-11 Progress Report of September 1975, states the purpose of the network as being:

- "(Art 1) that the network will facilitate research at the Nodal Centres into data processing problems and will permit the sharing of resources, and ... (Annex) that it will:
- 1 Allow the exchange of ideas and the co-ordination of research programs,

- 2 Allow the comparison of ideas for national networks and promote the agreement of standards,
- 3 Be a model for future networks, whether for commercial or other purposes, and will reduce the differences between future systems."

The Annex continues by saying that the hardware and software developed should be suitable as a basis for any permanent international network that might be built in the future.

To carry out the project the following bodies have been instituted:

- Management Committee, set up by the Agreement, comprising representatives of all Signatories, and having ultimate responsibility for the project,
- Executive Body, consisting of a Director who reports to the Management Committee, and three technical assistants,
- Technical Advisory Group, also comprising representatives of all Signatories, to advise the Director,
- Centres Co-ordination Group, responsible for guiding work that requires close co-ordination between the Centres,
- Ad hoc Working Groups and Special Interest Groups, concerned, for example, with drafting the specification of and assessing tenders.

Any organisation which applies successfully to its government for network access may use EIN.

2)

Configuration of the network

Diagram A20.1 shows the configuration of the network.

The network is packet switched, based on CII Mitra 15 minicomputer switches. Each node is capable of being connected to four other nodes. The trunk lines connecting the nodes are 9600 bps capacity leased from the PTTs. The nodes are located at what are called primary centres.

<u>Primary Centre</u>		<u>Host Connected to Node</u>
Euratom Italy	ISPRA (Italy)	IBM 370/165
	Politecnico (Milan)	Univac 1108
UK	NPL (London)	KDF-9 and NPL Network
France	IRIA (Paris)	Iris 80 - Cyclades Net
Switzerland	ETH (Zurich)	CDC 6400, 6500 PDP 11

In addition each country is nominating secondary centres to be attached to the nodes. The UK Atomic Energy Authority in Harwell, and the French Research Centre at Grenoble are examples.

The connection of EIN to the NPL network and the CYCLADES network has been possible via specially developed "Gateway" nodes. This aspect of research, i.e. internetworking, is one of special importance in the EIN project. The EIN network was designed with its own datagram communications protocol. As such it is not possible to connect it directly with Euronet, which is to be based on the CCITT X25 protocol. However, EIN are working on the development of two special interfaces for allowing terminals on the EIN network to access hosts on X25 networks and vice versa.

There are two other important research programmes related to the future development of EIN and networks. Firstly, a virtual terminal protocol (VTP), which allows any terminal supported by the network to access any host supported by the network. Secondly, a bulk transfer protocol (BTP) which will allow file transfer across the network in a simple



Diagram A20.1
Map of EIN Centres

manner. BTP is expected to be ready by early 1978 and VTP by the end of 1978.

3)

Applications

As already discussed, the major purpose of the network is research into data processing over networks to allow research centres to co-operate in the future. As a consequence the great majority of the transborder data flows are related to this research.

However, some usage of EIN as a transmission network has begun and various projects are being discussed.

1. The EIN documentation is held on a word processing system at the NPL called Scrapbook. Access to Scrapbook via EIN has already been demonstrated though it is not extensively used yet.
2. Access to remote databases via EIN is being planned. The INSPEC Database, holding keyword descriptions of technical papers (Physics, Electricity, Electronics, Computers) at Frascati has been nominated as a secondary EIN centre, and could be accessible to other EIN centres.
3. The Atomic Research Centres at Harwell (UK) and Euratom (Ispra, Italy) wish to share resources via EIN, primarily in scientific research, as do the National Physical Laboratory (UK) and the Centre Interuniversitaire de Calcul de Grenoble (France) in thermo-chemical research.
4. One ambitious project, which has been dropped, at least for the moment, is the Rutherford Laboratories connection to CERN (see Appendix A19). An experimental project connecting CERN to other High Energy Physics Laboratories (Rutherford, UK; DESY, Germany) via an ESA satellite is planned. The satellite link would be for high volume/high speed transmission of experimental data. However, part of the same project was the proposal to link the laboratories and CERN via EIN for remote access to the computer programs and data.

Two problems arose. First the budget was cut, which was the main reason for dropping the project. Second, however, was the problem of Rutherford (UK) access to EIN. Currently this is technically possible because Rutherford is connected to EPSS (q.v.) which is connected to the National Physical laboratory network which is connected to EIN. However, the overall path would mean that the National Physical Laboratory was used as a transmission path and this is against the agreement between the National Physical Laboratory and the British Post Office.

4) Security and privacy

There is little concern about aspects of privacy, primarily since it is a research network.

5) Traffic Types

At present traffic on the network is either interactive or of message switching type. Bulk data transfer will be offered in 1978, as discussed in Section 2 above.

6) Financial Aspects

Funds for the project are provided from two sources. First a common fund to which all signatories contribute and which up to the beginning of 1977, spent about 60m BF; secondly the individual expenditure incurred by signatories with centres which up to the beginning of 1977 amounted to about 40m BF.

In addition the lines leased from the PTTs have to be paid for. Although each link costs a different amount, at present the total is shared equally between the 5 centres, the total being about BF 625,000 per month.

For the time being there is no charge for network usage, which is reasonable since it is used primarily for research into network development.

Summary-OIPC-INTERPOL

NETWORK OPERATOR

OIPC (Organisation Internationale de Police Criminelle) is an intergovernmental organisation whose aim is to further cooperation between all criminal police authorities.

USERS

Communication on the network is between the Secrétariat Général (SG) and the central national offices (BCNS), or between the BCNS themselves.

APPLICATIONS

The network is used to transmit information required for solving crimes and identifying and tracing criminals internationally.

FUTURE DEVELOPMENTS

OIPC are evaluating the possibilities of a centralised computer database with terminal access from the BCNS.

PRINCIPAL CHARACTERISTICS

OIPC has a teleprinter network linking the SG in Paris with 58 countries. At present all traffic consists of message transmissions.

HETEROGENEITY

All network access is via teletypewriter.

SECURITY OF SERVICE

A BCN cannot transmit personal data that would infringe its own national laws. In addition, the SG can only operate in a country via the BCN.

COSTS

No information was available about the financial aspects of the OIPC-Interpol network.

Appendix A21

INTERPOL

1) Introduction

All the information on OIPC-Interpol was taken from a paper given by OIPC at the Vienna Symposium (September 1977).

OIPC (Organisation Internationale de Police Criminelle), is a recognised intergovernmental organisation, although lacking an official charter. Its objective is to ensure and further the co-operation between all criminal police authorities within the framework of the national laws of each country and the Universal Declaration of Human Rights. There are 127 countries affiliated to the OIPC.

To fulfil its objective OIPC needs to exchange information relating to criminal activities at an international level. For these international exchanges of information, OIPC uses the following organisations:

- a) A Secrétariat Général (SG) which acts as the international centre, and as a technical and information centre.
- b) At the national level, every country designates a police service that acts as a Central National Office (BCN - Bureau Central National) which liaises with the various services of its own country, with the BCNs in other countries and with the SG; the BCNs are part of their national administrations.
- c) The information between the different parts of OIPC is transmitted on an autonomous telecommunication network linking the SG with 58 BCNs; other than this network the OIPC uses normal postal services.

2) Configuration of the Network

OIPC does not have a data communications network, but rather a teleprinter network linking the SG in Paris with 58 countries. However they are at present evaluating the possibilities of a centralised computer database with terminal access from the BCNs, so the applications are relevant to the study.

3) Applications

OIPC is concerned with the information required for solving crimes, identifying criminals and tracing criminals internationally. In order to succeed in this it is inevitable that personal records are transferred between different countries. In general, the records transmitted will contain some of the following:

- name
- date of birth
- place of birth
- personal description
- photograph
- fingerprints
- past criminal record
- modus operandi
- other comments.

The records never contain information on political or religious beliefs, or private life details not relevant to criminal investigation.

The information sent to the SG or transmitted by it are kept on a manual file held by the SG. There are in fact two files:

- 1) subject files - 2,715,513 records
- 2) fingerprint files - 145,691 records.

It is proposed that these files should be computerised with terminal access from the BCNs, although they will be completely separate from national police systems in order to preserve the confidentiality of the data.

4) Security and Privacy

The information transmitted is either sent from the SG to a BCN or from one BCN to another. However, a BCN cannot transmit personal data that would infringe its own national laws. In addition, the SG can only operate in a country via the BCN, so it can only transmit data to the BCNs; this applies even when the SG may be working closely with another police agency.

Although OIPC takes great care to ensure confidentiality of information, the transmission and storing of personal data is an integral part of its work. If this means that certain individuals do not receive the same personal data protection as others, then OIPC believes that by their past reprehensible behaviour, they do not have the same right as others to data protection.

5) Traffic Types

At present all traffic consists of message transmissions:

In the year June 76 - June 77, 279,307 messages were transmitted on the OIPC network. Furthermore 18 BCNs gave statistics on BCN-BCN communications:

171,443 messages sent out
158,519 messages received.

Over the past few years the number of messages sent over the OIPC network has had an annual growth rate of 12 to 13%.

6) Financial Aspects

No information was available about the financial aspects of the OIPC-Interpol communications network.

Summary-SWIFT

NETWORK OPERATOR

SWIFT (Society for Worldwide Interbank Financial Telecommunications) a co-operative society created under Belgian Law and wholly owned by the member banks.

USERS

The users have to be banks and at present there are over 500.

APPLICATIONS

The SWIFT network provides users with a communications service for the transmission of international banking messages.

FUTURE DEVELOPMENT

The network is likely to be extended to several other countries (Australia, Greece, Ireland, Japan, Mexico, New Zealand, Portugal, Spain and South-East Asia).

PRINCIPAL CHARACTERISTICS

An International Message Switching Network with two switching centres (Amsterdam and Brussels) and national concentrators in 15 countries (Austria, Belgium, Canada, Denmark, Finland, France, GFR, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, UK and USA). There are over 500 banks connected and the number of terminals is well over 1000.

HETEROGENEITY

Access is primarily via the SWIFT Interface Device (SID) offered by Burroughs, General Automation and ICL (Singer). Banks can also use other interface equipment (Data Saab, IBM) though not supported by SWIFT. In addition access is also possible by telex or a teletypewriter.

SECURITY OF SERVICE

A very high level of security is adopted by SWIFT including access control, message numbering, data encryption, and message authentication.

COSTS

The costs of implementing and operating the network were not available.

APPENDIX A22

SWIFT

1)

INTRODUCTION

The SWIFT network is owned and operated by the "Society for Worldwide Interbank Financial Telecommunication", a co-operative set up under Belgian law. Its terms of reference are "for the collective benefit of the members of the Company, the study, creation, utilisation and operation of the means necessary for the telecommunication, transmission and routing of private, confidential and proprietary international financial messages between the members of the company".

The network had its origins in the late 1960s when it was realised that with the considerable growth of international banking, an international system enabling effective use of the bank's computing power was essential.

The requirement for international financial messages is an obvious result of international trade and other money relationships. Traditionally these messages have been carried between banks by telex or mail, or over private circuits in the case of those banks with their own international networks.

SWIFT takes over this message transport function, hopefully at a useful cost saving - although the tariff to be levied on the network has not yet been finally decided.

The first definite steps came when 68 banks from seven countries (Belgium, France, Germany, Italy the Netherlands, the UK and USA) set up the "MSP - Message Switching project" and commissioned Logica to carry out a feasibility study of an international network to transfer payment and related messages between the participating banks.

The study produced positive recommendations and in May 1973, 239 banks from 15 countries became founder members of SWIFT. Work had already begun on implementing the network. Test traffic was first sent over it in August 1976 and the network was opened for live traffic on May 9, 1977. On September 26, 1977 the initial phase of implementation was completed, with the cutover of concentrators in the USA and Canada so that service was available to the banks in all 15 countries. Over 500 banks are now members.

This cutover marked the beginning of a second implementation phase, due for completion in April 1978, in which the network facilities will be extended.

After completion of Phase 2, service will be extended by placing a concentrator in Japan, and connecting banks in Ireland through the British concentrator. Banks in Australia, New Zealand, Spain, Portugal, Greece and Mexico are also interested in joining the system, and a third switching centre will probably be added in the USA to those already installed in Brussels and Amsterdam to handle West Coast and South-East Asia traffic.

2)

Configuration of the Network

The basic configuration of the network is as shown in Diagram A22.1 It is essentially a star network with twin centres at Brussels and Amsterdam. Concentrators in each of the participating countries are linked to one or other of the centres over 9600 bps private circuits.

Member banks access the network through a "SID" (Swift Interface Device) or in some cases a privately supported alternative. SIDs are supplied by Burroughs, General Automation and Singer (now ICL), and the software is supplied and maintained through SWIFT. Some banks use other interface equipment, including IBM System 7, Data Saab, and "IBM Direct Link" which provides a direct interface between SWIFT and an IBM mainframe, but in these cases the software must be independently supported.

- Primary Circuit
- - - Back-up Circuit
- ▲ Concentrator
- Switching Centre

Diag. A22.1
SWIFT Network
(1977)



Access is also possible via telex. Banks with relatively small flows can share the use of a SID. SID's and concentrators are located in 15 countries (Austria, Belgium, Denmark, Finland, France, German Federal Republic, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland and the UK in Europe; Canada and the USA outside Europe). Other countries are planning or considering a link to the network, as mentioned above.

SIDs are linked to a national concentrator, usually, over 2400 bps private circuits. The concentrators are Burroughs B775's. Burroughs B774 Frond End processors support the private circuit linked to these concentrators; the mainframes at the switching centres are duplicated B4800's.

Details of the number of terminals in each country were not available. However, SWIFT had 503 member banks as at September 1977. Not all these banks are connected as yet. Of those that are, most have just one SID, but some share them and others have more than one. The number of terminals supported by each SID may range from one or two to 50 or more. The total number of terminals with access to the network runs into thousands. The network can be accessed by telex, but it does not carry voice traffic at all.

Applications

The SWIFT Network is essentially dedicated to the transmission of international financial messages. This application embraces four categories of messages as shown below.

<u>Category</u>	<u>Message Group</u>
1. Customer Transfer	Customer Transfers
2. Bank Transfers	Bank Transfers Advice to receive
3. Foreign Exchange	Foreign Exchange Fixed Loan/Deposit Call/Notice Loan/Deposit Interest payment
4. Special Messages	Confirmation of Debit Confirmation of Credit Statements.

The message switching application does not access a database as such, although a) the sender and the receiver may either or both interface a computer database of financial transaction information direct to the network through the SID; b) SWIFT keeps a central file of messages for recovery in case of need.

The operating centres hold the following information:

- a database with the technical specifications of the interfaces,
- the file of messages transmitted,
- statistical and billing procedures and records.

The message file is held on a real time file for 2 days, on disc packs loaded as required for a further 10 days, and then on tape for minimum of 4 months; this covers the requirement that any claim must be notified to SWIFT within 3 months of a transaction.

The files are duplicated in Brussels and Amsterdam. The central computer systems do not process the messages forwarded through them; however, they do carry out various functions as follows:

- Receipt and transmission of messages
- Message validating and acknowledgement
- Message accountability and security
- Message routing and delivery control
- On-line and historic message storage
- Network control and re-configuration
- Data recovery and diagnostic.

The operating centre checks the validity of incoming messages, and stores copies in the online file and the retrieval file. It then issues an acknowledgement of the originating terminal. Even if the message fails the validation check, it is recorded and the originating terminal operator is given appropriate error information. The messages are then routed, and queued for output on the basis of message category and priority status. The appropriate concentrator acknowledges the message after delivery to the exit centre, or notifies non-delivery together with the reason.

All SWIFT Messages are to a strictly defined format, and indeed these formats for interbank transactions are in the process of being adopted - more or less unchanged - as a standard by the International Standards Organisation (ISO 4217). Each message consists of an envelope with routing and system information and the user text, defined by the Message Text Standards. These specify the fields that may be included in the message type which may be either mandatory or optional. Each field is preceded by a field tag and is written according to a specific format. This allows facilities such as translation of messages into the national language by the receiving SID on output.

For example, an ordinary customer transfer message can have 12 fields, of which only 4 are mandatory. The mandatory fields are concerned with the transaction reference number, the value of the transaction, and the identity of the ordering customer and the beneficiary. Other fields carry details of the banks involved, reasons for the payment, and so on. A maximum of 2000 characters is allowed per message.

Access to SWIFT is only available to member banks. If a bank wishes to join SWIFT, its application is first considered by the member group in the country concerned. If accepted the application is submitted to the SWIFT main board for approval. National banks such as the Bank of England are members.

4) Security and Privacy

Security measures on the SWIFT Network include:

- a) Physical and personnel security measures
 - b) Coded log-in procedure
 - c) Input sequence number
 - d) Output sequence number
 - e) Encrypted transmission
 - f) Message Authenticator.
- a) Physical and personnel security measures at the user bank branches must be the responsibility of the banks concerned, and in practice they vary greatly in the standard of security provided. SWIFT's security procedures have been audited by external consultants and found to reach a very high standard.

- b) Access to the system within the banks is controlled by a log-in procedure, which is designed so that full knowledge of it can be split between up to three people. The log-in procedure fulfils three basic functions.

- it confirms to the system which terminal it is communication with,
- it confirms to the terminal that it is communicating to SWIFT,
- it specifies the use of the system the bank requires for a terminal.

The log-in procedure consists of an exchange of message between the terminal and the system. The terminal first sends a message to the system specifying:

- the identification of the terminal,
- an authorisation code,
- the use of the system to be permitted to that terminal

- c) Every message received by SWIFT must have an input sequence number, allocated by the sending bank, which is checked by SWIFT to ensure it is the next sequential number due.

Any message with an out of sequence ISN is rejected and not forwarded through the SWIFT system.

The sending bank is informed of the correct sequence number and logged-out.

- d) Each message delivered by SWIFT contains an output sequence number particular to a terminal for checking by the receiving bank. If an out of sequence message is received by a bank, that bank is responsible for retrieval of the missing messages and investigation of the situation.

- e) SWIFT is responsible for all transmission facilities between concentrators and switches. To achieve the required level of privacy SWIFT utilises data encryption procedures which renders the data unintelligible to unauthorised listeners and amendments to any part of a message renders that message void.
- f) Banks are responsible for the authentication of messages. To aid them in this responsibility SWIFT is providing an algorithm as the basis for an Authenticator. The use of the Authenticator is mandatory within SWIFT on all payment messages.

5) Traffic Type

All the traffic using the network is message switched. Figures for the volume of data flow were not provided by SWIFT, except to say that the level of traffic was considerably lower than that foreseen in the original 1974 study. From other information provided by participating banks we estimate that total traffic flow as of October 1977 was of the order of 30,000 messages per day. However, this figure can be expected to increase substantially over the next year or two.

6) Financial Aspects

The finances of SWIFT are currently a sensitive topic because of the negotiations now going on between SWIFT and the various telecommunication administrations concerned about the usage related tariff that is being applied to the network and the level it should be set at.

Actual costs for implementing and operating the network were not available.

Charges to member banks for access to the network are split into two parts. 50% of the total cost is levied as a fixed subscription per member, and the remainder is charged on the basis of usage. At present, usage charges are based on the 1974 survey of likely usage of the network; as experience builds up the usage charge will be based on actual traffic sent. The charge is calculated on the number of messages sent, their length (the basic fee covers messages up to 325 characters) and whether they are sent by urgent or normal priority.

Summary-SITA

NETWORK OPERATOR

SITA (Société Internationale pour la Télécommunication Aéronautique) is owned on a corporate basis by a community of Airlines.

USERS

Only airlines are allowed to access the SITA network.

APPLICATIONS

The two applications supported by the network are passenger seat reservations and administration. By agreement only airline business is permitted on the network.

FUTURE DEVELOPMENTS

By improving the performance of switching nodes and lines SITA expect the network to last until the early 1980s, at which time they should have begun to phase in a new network.

PRINCIPAL CHARACTERISTICS

High Level Centres (HLCs) are the switching computers, to each of which are connected various satellite processors and reservations computers. Most lines operate at a speed of 4800 bps, with some operating at 9600 bps. SITA operate in some 118 countries worldwide, and in 1976 about 1800 terminals were accessing the network. Data traffic is of packet switching or message switching type.

HETEROGENEITY

The 20 reservation computers are all either IBM or Univac machines. Terminals are supplied by Univac, Raytheon, IBM and many others.

SECURITY OF SERVICE

Terminals are only allowed to access their own hosts. The packet format allows user text to be free format, and so SITA has little chance of monitoring traffic, which happens on the message switching application.

COSTS

The operating cost in 1976 was about \$65m, including line, equipment and staff costs, of which one third is estimated to be line costs.

Appendix A23

SITA

1) Introduction

SITA (Société Internationale pour la Télécommunication Aéronautique) is owned on a corporate basis by a community of Airlines. At present the number of Airlines is just over 200.

On behalf of these member Airlines, SITA manages and operates a world-wide telecommunications network.

Once a year, in May in Brussels, a General Assembly of SITA members is held, at which a board of directors is elected to govern SITA and to ratify any major proposals the staff of SITA propose. The method for electing board members is based on an artificial shares system. Shares are allocated to each Airline based on its usage of the network during the previous year. Any Airline which is allocated more than 20 shares automatically nominates a board member. Last year there were 17 such cases, the biggest users being Lufthansa, Air France and British Airways. The remainder of the board (6 seats in 1976) are nominated by groups of airlines who collectively have at least 10 shares. The board meets formally 4 times a year, but a sub-group meets more often to ratify any internal proposals. The SITA administration can, in general, make decisions up to a value of US \$250,000; anything bigger needs ratification.

When SITA has a new proposal, the general procedure is to submit it direct to the Airlines concerned. If the proposal is acceptable then it is submitted to the board.

SITA has 200 people (administrators and engineers) working in Paris and a further 1300 people scattered around the world in some 118 countries, where they operate SITA centres and act on behalf of SITA.

History

SITA was founded in 1949 by a group of 11 airlines. The objective was to set up a shared communications facility which the IATs could not conveniently offer and which, individually, each airline could not justify.

The network began as a number of low speed teleprinter circuits, with messages being relayed at centres on a torn-tape basis. The rapid growth in usage led to the automation of the message switching centres and standardisation of message formats: Frankfurt had an automatic centre in 1966 (Univac 418) and similar centres were set up in three other countries (using either Univac or Philips computers).

Inspired by the success of the network, the Airlines began to feel that the low speed network should be improved. Responses to enquiries were taking up to an hour and it was felt that this should be much reduced. SITA were already making plans for a high level network linking nine centres with voice grade lines, by adding to the existing four centres mentioned above. The new network, consisting of high level centres at London, Paris, Rome, Beirut, Frankfurt, Madrid, New York, Hong Kong and Amsterdam, was operational in September 1970. It was still based on message switching with drum storage. Transit time through the network was down to about one minute. However, the BEA computer reservation system using VDUs in the Rome sales office required a response time in terms of seconds. SITA had foreseen this requirement and by December 1971 the network catered for two types of traffic on the network: Type A and Type B. Type A was for the new computer reservation systems and was core switched through the network forming the first commercial packet switching network in the world. Type B was the conventional message switching traffic.

Until 1973 BEA was the only Airline using the service. Then Air France (and its clients Air Afrique, UTA and Sabena) connected their equipment, followed in 1974 by Swissair and South African Airways. In 1977 there were 20 Airline Reservation Systems linked to SITA, many of them offering the service to a number of other Airlines.

The reason for Airlines using an International Network is that Airlines sell seats from many international locations. Originally they used a "block allocation" system which is not satisfactory. If a centralized system is to be used then international communications are necessary. Telephones are too expensive and not always reliable, and message switching is too slow.

The reason for using SITA is purely resource sharing. When an airline can justify a private line to its reservation computer it will put one in. However, the SITA network allows airlines to have agent sets in locations which could otherwise not be justified.

The growth in Type A traffic has led SITA to the consideration of how long the present network will be able to cope. By improving the performance of the switching nodes and the line speeds they expect the network to cope until the early 1980s by which time they should have begun to phase in a new network with much better performance and capacity.

2)

Configuration of the Network

Diagram A23.1 shows the configuration of the network. To give an idea of the rapid rate of change, 5 new lines have already been added and the Paris-Frankfurt link has been upgraded to 9600 bps. All circuits are used for data traffic only.

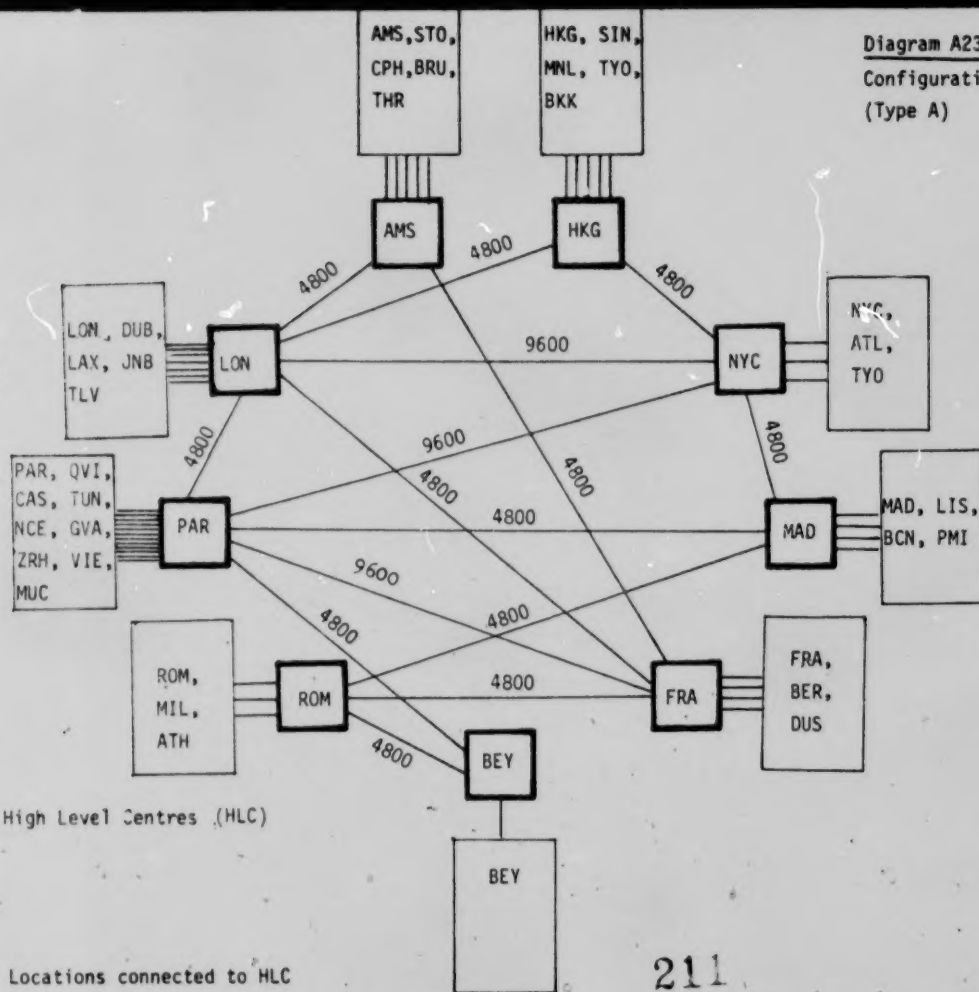
The network consists of two levels. The first level links the High Level Centres (HLCs).

The HLCs are the switching computers forming a high level switching network. To each of the HLCs various satellite processors and reservations are connected. The Satellite Processors then connect to Agent Set Control Units and also to Reservation Computers and Agent Sets (terminals). The Satellite Processors are manufactured by Raytheon Cossor (706 and the new RDS 500) and by Thomson Houston (4020).

SITA is responsible for the network up to the Satellite Processors. The ASCUs, Agent Sets, Reservation Computers and the lines linking these equipments to the network are the responsibility of the Airlines.

Diagram A23.1

Configuration of SITA Network
(Type A)



Hosts

There are twenty Reservation Computers on the network; all of them are either IBM or Univac machines, as they are the only two manufacturers who offer Airline Reservation Systems. The only requirement for connecting a host to the network is that the necessary protocols are observed. If an airline wanted a new host, then the airline, SITA and the manufacturer would have to implement the required interfaces.

Terminals

There are a variety of different terminals able to access the network. Apart from teleprinters, the agent sets are VDUs made by Univac, Raytheon, IBM and many others.

No breakdown by country is available, but in 1976 there was a world wide total of about 1800 agent sets connected and about 34 satellite processors.

3)

Applications

As has already been mentioned there are two types of traffic on the network: A and B. This study is concerned with data traffic, type A. However, type B will also be discussed briefly.

Type A

Type A is exclusively used for "Passenger Seat Reservations". A sales office at a remote location will interrogate its airlines' reservation system to establish what seats are available on particular flights. If the response suits the customer, then a booking will be made. Essentially, therefore, there are two types of records stored on the reservations systems:

1. Availability of Seats and Flights
2. Reservations.

The Passenger Reservations Record is an identifiable personal record in as much as the following details are normally held:

1. Name
2. Address (possibly telephone number)
3. Origin
4. Destination
5. Flight Details.

Other types of applications which have been considered for the future are Freight Reservation, Maintenance and Spare Parts Location and Crew and Plane Rotation. At present there is no interconnection of reservation systems.

Type B Applications

Type B traffic is used in two ways. Firstly for Passenger Seat Reservations by those airlines which do not use Type A. Secondly, in a similar manner to international Telex, i.e. for administrative information. SITA also uses the type B network for its own administration.

User Community

Only Airlines are allowed to access the SITA network. In principle an airline would have a reservation computer located in one place and agent sets located in sales offices all over the world. These sets would then access the reservations computer either via direct leased lines or the SITA network. In practice, only the world major airlines can afford reservations computers and so they offer a service to other airlines.

e.g. Iranair uses KLM's CORDA system in Amsterdam. In this instance the Iranair agent sets would access CORDA via SITA.

Another interesting example is GABRIEL, SITA's own reservation system. Owned by Control Data (on a Univac computer) it was not profitable and came up for sale at an attractive price and was bought by SITA in 1976. They now offer the reservations system on a service bureau basis. It has 3 types of customers:

1. A US Airline for just the USA Internal service using polled lines (332 agent sets)

2. VARIG (Brazilian) using private lines from Rio de Janeiro and Sao Paulo
3. Eastern Block Airlines (e.g. Maler, Hungary) via SITA Network (359 agent sets).

The third is interesting because GABRIEL is in Atlanta, Georgia, USA.

Also of interest is British Caledonian's system which is in Los Angeles.

4) Security and Privacy

Although the interactive network is only used for the reservations system, the only actual restriction is that it should be airline business. The packet format allows the user text to be free format, as far as SITA is concerned.

This means that SITA has little chance of monitoring this traffic. The one control exercised by the network is that terminals (agent sets) are only allowed to access their own hosts, and this is always checked. It would be very difficult and extremely expensive for SITA to actually intercept, decode and therefore monitor type A messages.

As far as the relevance of data protection laws is concerned, it is clear that if passenger details are considered sensitive data, complying with the laws would have to be the Airlines' responsibility. However, SITA itself is probably more aware of the possible impact of such laws than many airlines and has already begun investigating what action will be required on its part. Although it is all but impossible for SITA to monitor type A traffic details, as long as it is theoretically possible they believe they may have to increase their security systems. At present very few of their centres have security measures for access to computer rooms and they consider that this will have to be changed in the near future, i.e. "They will have to lock the doors". In this way no-one but the authorised users and themselves could have access to the data "flying on the network", excluding the PTTs.

5)

Traffic Types

The dramatic growth of the service can be seen by comparing the growth of Type A and Type B traffic. In 1974 Type A traffic represented 7% of the total traffic, whereas in 1976 it represented over 37%! Type B has also continued to grow but at decreasing rate: in 1974 it had a growth rate of 10%, in 1975 about 8% and in 1976 only 5%.

Total traffic in 1976 was as follows:

Type A	Type B
Packet Switching	Message Switching
38 billion characters	65 billion characters.

6)

Financial Aspects

The operating cost in 1976 was some US \$65m (note that in 1974/5 it was about US \$45m). The US \$65 million can be split roughly into:

1/3 line costs including teleprinters
1/3 operation and equipment
1/3 personnel.

For 1977 the investment budget will be US \$13m, but this figure is rather high because of the extensive improvements being made to the network. In 1978 the figure for investment should be US \$8m.

SITA charges the airlines for use of the network. For type A traffic there is a connection charge and a character charge. However the character charge is based on monthly samples and has been considered unsatisfactory. When the Advanced Network is implemented in the early 1980's there will be an accurate measuring system to charge usage.

The SITA network is heavily loaded, more heavily than SITA would like for efficient performance, but they are forced to use this loading because of economics. They feel that a volume sensitive tariff will not favour such a user. As far as the Public Data Networks are concerned, SITA would like to use any service which is available as long as it meets their requirements. Because it is not likely that there

will be a world-wide Data Network for many years to come, they have to plan their progress based on private networks.

Summary-IIASA

NETWORK OPERATOR

IIASA (the International Institute for Applied Systems Analysis) is an internationally financed research institute located near Vienna.

USERS

The network link is used by the staff of the IIASA energy project.

APPLICATIONS

The remote computers carry a database of statistical and modelling information used to develop models of the world energy system.

FUTURE DEVELOPMENTS

IIASA is the main centre of a project to set up a packet-switched network linking research institutes, mainly in Eastern Europe.

PRINCIPAL CHARACTERISTICS

The Institute has a permanent private circuit to an Italian research centre in Pisa. Traffic using the link is a mixture of interactive terminal work and remote job entry and output.

HETEROGENEITY

The IBM hosts in Pisa can be accessed directly from a teletype terminal at IIASA or through a WANG minicomputer.

SECURITY OF SERVICE

There are no special security restrictions on the use of the data link.

COSTS

The cost of the line to Pisa is about \$50,000 p.a.

Appendix A24

IIASA

1) Introduction

The International Institute for Applied Systems Analysis is an internationally-financed research institute located in a former summer palace of the Austrian Emperors at Laxenberg, just south of Vienna. The Institute is mainly financed by the USA and the USSR, as a symbol of detente and has about 120 staff. Its task is to carry systems-oriented research on topics of interational interest and it makes considerable use of computers in its work.

IIASA is the main centre and manager of a project to set up a packet-switched network linking a number of research institutes, mainly in Eastern Europe. However, this network is not working as yet, except intermittently over temporary private circuits and the dial-up network, and so it is not discussed here. The Institute also has a permanant private circuit to the Italian Istituto Del Consiglio Nazionale Della Ricerca at Pisa, which is in regular use and provides a good example of a trans-border data flow for scientific and research purposes. The circuit was installed in April 1977 and has been in full use since August 1977.

IIASA decided to make use of the international link for two principal reasons; a) because it was offered favourable computing rates by the remote Institute; b) because it was eager to involve researchers in other countries, and in Italy in particular, in the work of IIASA.

2) Configuration of the Network

The configuration of the network is shown in Diagram A24.1; the computer complex in Pisa can be accessed directly from a teletype terminal at IIASA or through the WANG minicomputer

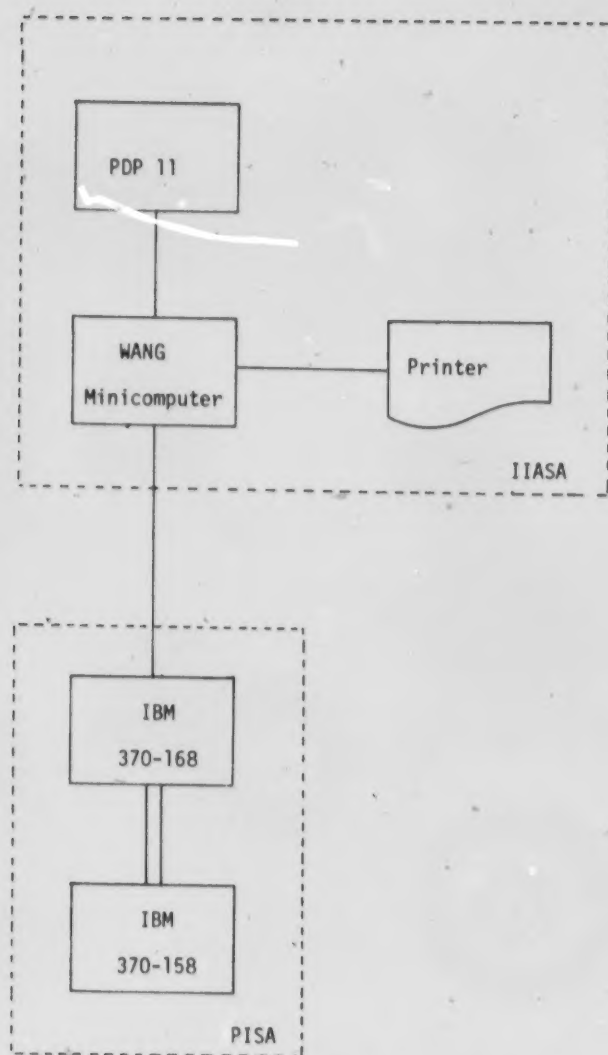


Diagram A24.1 IIASA Network link

3) Applications

The link to Pisa is used for the "energy project", IIASA's single biggest research programme. Basically this is concerned with the study of the options available to the world-wide energy system and their characteristics in terms of demand, supply, environmental problems, and so on.

As part of this project, IIASA has developed some large long-term models of the world energy economy which are run on the remote IBM machines. For this purpose the remote machines carry a database of statistical and modelling information which has been collected by IIASA from worldwide sources.

At present, the link is entirely dedicated to this application, and the only users of it are located at IIASA.

4) Security and Privacy

There are no special security restrictions on the use of the data link. One comment was "the questions of privacy and security just don't seem to arise".

The link is available to the staff of the IIASA energy project, although in practice the task of running models on the remote computers is the responsibility of particular members of the team. There are no particular controls to restrict access.

5) Traffic Types

The traffic using the network is a mixture of interactive terminal work and remote job entry and output. In terms of bulk the latter is by far predominant. The line is currently in use for up to 5 or 6 hours on a typical working day, suggesting a traffic volume of approximately 5 million characters per day.

6)

Financial Aspects

The costs of setting up and operating the network are absorbed in IIASA's overall budget, but the cost of the line to Pisa is about US \$50,000 a year. This provides access to a computing facility which would be worth in the order of US \$200,000 a year at normal commercial rates. Thus the communications cost is considerably less than the value of the computer time involved, but if the private circuit rental was substantially increased, use of the international link would probably become uneconomic.

Summary-EURONET

NETWORK OPERATOR

The network is owned jointly by the 9 PTTs of the Euronet Consortium and the EEC Commission, the PTTs being responsible for its operation.

USERS

Anyone who subscribes to Euronet may use the network.

APPLICATIONS

The host computers will support bibliographic and factual databases concerning a wide variety of subjects.

FUTURE DEVELOPMENT

The network is expected to start operating at the end of 1978, and the installation of further packet switching exchanges is planned.

PRINCIPAL CHARACTERISTICS

An international packet switching network with switching exchanges in Frankfurt, London, Paris and Rome. Remote access facilities will be available in Amsterdam, Brussels, Copenhagen, Dublin and Luxembourg for low speed access via terminals connected to the PSTNs in each country. Internode links will operate at speeds of 9.6 and 48 kbits/s.

HETEROGENEITY

Network access will be possible via X25 interfaces, direct connections, and over public switched facilities. A special protocol ESP25 enables non-intelligent terminals to communicate with host computers.

SECURITY OF SERVICE

Not applicable.

COSTS

The total cost of EURONET is very difficult to determine. However, as far as the current implementation is concerned the Community contribution to the network will be FF 17m, whilst the PTTs will contribute a total of FF 7m to the network investment. Charges for using the network will consist of a connection charge, a monthly rental and a usage charge. The usage charge will be independent of distance, but will be dependent on volume of data transmitted and connect time.

Appendix A25

EURONET - EEC PUBLIC DATA NETWORK

1)

Introduction

The commission of the European Economic Community recognised in 1971 the need for a data network which would enable terminals in any of the EEC countries to have access to databases held at various locations within EEC countries. The plans envisaged a later extension of the network to non-EEC countries. The nine European PTTs involved were approached in 1975 by the EEC Commission. The PTTs formed a Legal Consortium later that year and empowered the French PTT to sign a contract with the EEC on their behalf.

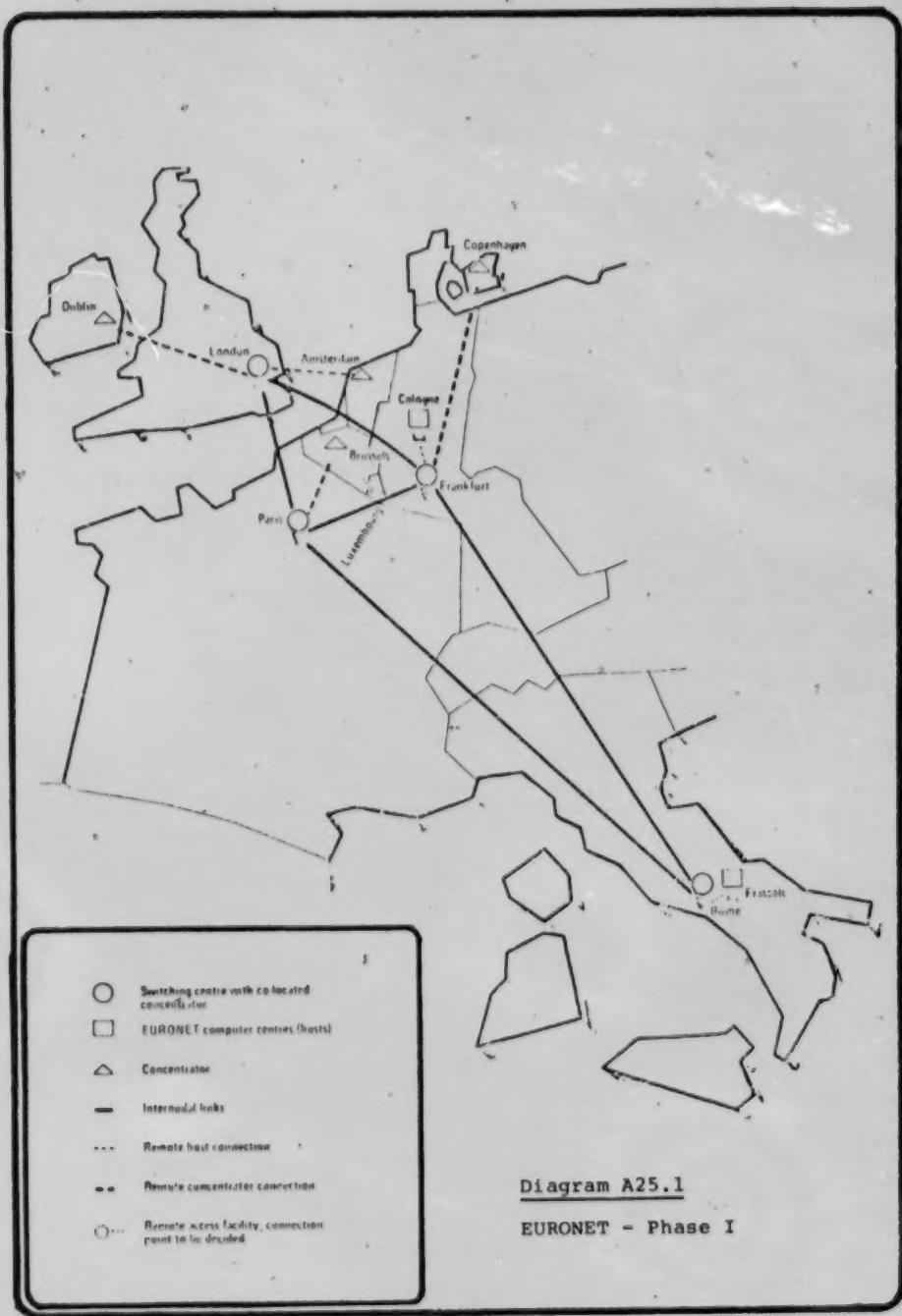
It is scheduled that the network will start operating in 1978 with the configuration shown in Diagram A25.1.

The network is owned jointly by the nine PTTs of the Euronet Consortium and the EEC Commission, the PTTs being responsible for its operation.

2)

Configuration of Network

EURONET will be a packet switched network largely based on the design of the French PTTs network Transpac (q.v.), using TRT CT50 switching units and SEMS Mitra 125 processors. The packet switching exchanges will be located at Frankfurt, London, Paris and Rome with remote access facilities in Amsterdam, Brussels, Copenhagen, Dublin and Luxembourg for low speed access via terminals connected to the public switched telephone networks in each country and multiplexed lines to the exchanges. A common packet switched network was preferred to separate star-shaped networks due to lower cost and the need to provide for a large number of often incompatible terminals.



EuroNet will establish X25 protocols for host computers to talk to each other. A special protocol ESP25 (CCITT X3, X28 and X29) enables non-intelligent terminals like teletypes to communicate with the host computers.

Internode links will have a speed of 9.6 and 48 kbits/sec; Customer Access will be of 4 possible types:

110 - 300 bps - Asynchronous Dial-up
1200/75 bps - Asynchronous Dial-up
600/1200 bps - Asynchronous Direct
2.4, 4.8, 9.6, 48K bps - X25 interfaces.

That is, users will be able to access the network over public switched facilities 110 - 300-bps and 1200/75 bps (telephone).

It is expected that further packet switching exchanges will be added, as non-EEC countries like Spain and Switzerland wish to gain access to some of the databases in EEC countries.

3) Applications

At the end of 1978 when the network will start operating it is expected that 27 host computers will be connected, offering about 90 data bases on medicine, chemistry, engineering, textiles, agriculture, socio-economic data, legislation, environment, electronics, physics, metallurgy, aerospace, nucleonics and patents. The planned host computer centres and their databases are shown in Table A25.1.

The databases available will be of two types:

- bibliographic
- factual (requiring frequent updates)

In addition there will be a multilingual Thesaurus and glossaries to overcome the language barrier.

A study commissioned by the CEC has forecast that by 1985 there will be a user demand for some 2,350,000 on-line queries to Scientific and Technical Information (STI) databases per year throughout Europe.

Table A25.1: Data Base Services Offered for Initial Connection to Euronet

	<u>Host</u>	<u>Location</u>	<u>Data Bases</u>
1	British Library (BLAISE - British Library Automated Information Service)	London area	UK Marc, US Marc, Medline, Sdiline, Toxline, Chemline, Cancerline, other British Library data bases (including the B.L. Conference Index)
2	Info-Line	London area	CAS, INSPEC data bases, Derwent data bases, and other, mainly UK, data bases
3	Computer Aided Design Centre	Cambridge	Engineering design
4	National Computing Centre	Manchester	Computing Hardware, Computing Software, Computing Services, Computing Education, Computing Literature, Computer Installtions
5	Belgian Ministry of Economic Affairs	Brussels	INIS, EPIC
6	DIMDI/FIZI	Cologne	Biosis, Cancerline, Poisons data bank, Excerpta Medica, IDIS (Social Medicine) CAB Index Veterinarius, Inter- national Pharmaceutical Abstracts, Hospital Affairs, Medline, Psychological Abstracts, Science Citation Index (Asca IV), Toxline, Sport Science
7	IDC/FIZ3	Frankfurt	Chemical Abstracts Conden- sates (CAC), Chemical Abstracts Subject Index Alert (CASIA), Chemical Industry Notes (CIN), IDC - Literature documentation,

<u>Host</u>	<u>Location</u>	<u>Data Bases</u>
		IDC - Patent documentation, DECHEMA - Literature documentation, DECHEMA - Materials data documentation, Literature documentation on plastics, rubber and fibres, Literature documentation on process engineering
8 ZAED/FIZ4	Karlsruhe	Astronomy and Astrophysics Abstracts, Compendex, Energy data base, NTIS, Nuclear research and technology data base (IKK), INIS, INSPEC - Physics, Mathematics information system (MIS), NSA, Physics information system (PHIS), Physical data information system, High energy physics data base (HEP), Plasma- physics Index, Plasma- physics Technology Index, Surface and Vacuum Physics Index, Cambridge crystallo- graphic data files, Evaluated nuclear structure data file (ENSDF), Conference calendar for energy, physics, mathematics, Conference reports on aerospace, Data base on institutions
9 DOMA, ADE/FIZ16	Frankfurt	DOMA mech. engineering literature data base, ZDE elec. engineering literature data base, DRE electrical engineering data base, Compendex, INSPEC - Electrotechnology/Computers and Control
10 ZMD	Frankfurt	AGRIS, Agricultural sciences literature data base, Food Science and Technology Abstracts, SDIM, Deutsche Bibliographie

	<u>Host</u>	<u>Location</u>	<u>Databases</u>
11	Institut Textile	Paris	TITUS III
12	Centre Interuniversitaire de Calcul	Grenoble	Cancernet Sabir, Pascal medical data bases
13	Fédération Nationale du Batiment (CATED)	Paris	Ariane
14	Necker Hospital	Paris	Drugs data bank (BIAM)
15	Thermodata	Grenoble	Thermodynamic data
16	PLURIDATA	Paris	Chemical data banks (including crystallographic and mass spectrometry data, nuclear magnetic resonance data, DARC system)
17	INRA - Ministère de l'Agriculture	Paris	CAB, CAIN, Zoology, Bioclimatology, CDIUPA (food science technology)
18	French Host.	France	CBAC, DARC system
19	Institut de recherche des transports	Paris	IRRD
20	SDS	Frascati	CAS, SCISEARCH, INSPEC - Physics, Electrotechnology, Computers and Control, Compendex, NTIS, World Aluminium Abstracts, NASA, Electronic Components, Metadex, Environmental Science Index, Pascal Data Bases, Pollution Abstracts, Oceanic Abstracts, Biosis
21	Commission of the European Communities	Luxemburg	Community data bases
22	Datacentralen	Copenhagen	CAS, Food Science and Technology, Medline through SCANNET), Compendex

<u>Host</u>	<u>Location</u>	<u>Databases</u>
23 CNUCE	Pisa	Data bases on: ecology geothermal science, icono- graphy, oceanography, legal documentation, fine arts, citation index (Italian authors)
24 Interfaculty Computing Centre	Rome	US Marc, Marc Italy, SPIN
25 Interfaculty Computing Centre	Naples	MTS
26 CSATA	Bari	Meteorological data bank (concerning the South of Italy), agriculture
27 Joint Research Centre	Ispra	Nuclear sciences, material properties and other data bases

Source: EURONET News, July 1977.

The anticipated ratio of searches within a given Community country and to other countries is summarised in Table A25.2.

In the larger countries especially, many of the searches will be national, for example in the UK 65% of all searches are expected to remain within the United Kingdom with most of the external searches being made to Data Bases in Germany.

About 44 Euronet dial-up ports will be provided at opening date growing to 81 by 1980 or earlier depending on demand. Table A25.3 shows the spread of terminal interfaces in the United Kingdom and the community as a total.

In addition to its prime use as a database enquiry transmission network, the EEC agreement allows the PTTs to develop the network for the purpose of creating a public data network and to use any or all of the spare capacity of the network which is not required for EURONET. This almost certainly means EURONET will form the basis of a European Public Data Network.

4) Security and Privacy

Not applicable.

5) Traffic Types

Initially all the traffic will be for on-line enquiries to databases. Later however it will form part of the public data networks and have more diverse traffic types.

6) Financial Aspects

The Euronet charging structure was announced in February 1978. The structure is made up of three elements:

- a connection charge
- a monthly rental
- a usage charge which is the same throughout Europe.

Table A25.2: Ratio of Country to Country Searches in 1979

Data Base Suppliers	Demand									
	Belgium	Denmark	France	Germany	Ireland	Italy	Luxembourg	Netherlands	United Kingdom	
Belgium	21	2	24	0	1	11	0	16	23	98
Denmark	55	105	214	27	5	125	1	128	163	834
France	70	20	1273	54	4	136	6	144	163	1870
Germany	123	37	410	2536	9	250	1	240	324	3931
Italy	49	16	170	27	4	455	1	104	140	966
United Kingdom	82	25	286	27	45	159	1	168	1508	2301
	411	205	2377	2671	68	1139	11	800	2321	10000

Ratio of total searches supplied

Source: Paper given by PTF Kelly (British Post Office) to the Institute of Electrical Engineers-February 1977.

Table A25.3: Spread of Terminal Interfaces (those in brackets being unequipped) at Opening Date

	CHARACTER MODE			PACKET MODE
	Asynchronous		Synchronous	
	PSTN	Direct	Direct	Direct
United Kingdom	81(44)	11(10)	1(1)	4
Community Total	348(186)	54(49)	8(8)	28
UK% of Total	23	20	13	14

Source: Paper given by PTF Kelly (British Post Office) to the Institute of Electrical Engineers-February 1977.

The connection and rental charges will be set by the national PTTs and will depend on the method of access. Examples of the charges as quoted by the UK Post Office are given in Table A25.4. Though the PTT administrations will be responsible for setting the tariffs and collecting the charges, they will have to bear in mind EURONET agreements.

The total cost of development and implementation of EURONET is impossible to determine as it involves many studies and the time of many officials. However, as for the current implementation is concerned, the Community Contribution will be 17 million French Francs and the PTT Administrations will contribute a total sum of 7 million French Francs to the network investment.

Table A25.4 : Sample Euronet Charges
(Quoted by UK Post Office)

1 Connection Charge and Rental

<u>Method of Access</u>	<u>Charge</u> <u>(£)</u>	<u>Annual</u> <u>Rental (£)</u>
Dial-up	25	20
Private Circuit (1200 bps)	150	575

2 Usage Charge

(a) Volume charge

£1.15 per 1000 segments, each segment
comprising 64 bytes.

(b) Connection time charge

<u>Method of Access</u>	<u>Charge per hour</u> <u>(£)</u>
Dial-up (to 1200 bps)	1.35
Private Circuit (to 1200 bps)	1.00
Private Circuit (to 9600 bps)	1.35
Private Circuit (to 48K bps)	3.60

or (c) Permanent Virtual Circuit

<u>Speed</u>	<u>Monthly Charge (£)</u>
1200 bps	120

Summary - The Nordic Data Network

NETWORK OPERATOR

The Telecommunications Administrations in Denmark, Finland, Norway and Sweden are responsible for the network.

USERS

The network will be available to anybody since it is a public facility.

APPLICATIONS

The network is a transmission medium for users of data communications and therefore can be used for any application.

FUTURE DEVELOPMENTS

A study is under way to evaluate the possibilities of offering packet switching services on the network, which at present is circuit switched. Thereby, connection to Euronet will be possible. Discussions for connection to the German Public Data Network are also underway.

PRINCIPAL CHARACTERISTICS

A circuit switched network with 4 Data Switching Exchanges (DSE) connected to each other by means of high speed lines operating at 64 kbits/second. In addition, various data circuit terminating equipment, terminals and multiplexors are connected to the network by subscriber and multiplexed lines.

HETEROGENEITY

The DSEs will be supplied by L.M.Ericsson, based on their AXE 30 electronic switching exchange. Any hardware conforming to CCITT recommendations may be connected to the network.

SECURITY OF SERVICE

Security measures include closed user groups, direct call facility, and calling and called line identification.

COSTS

No information was available about the cost of implementing and operating the network. The charge for using the network will have three components, a connection charge, a rental charge and a usage charge. The usage charge will probably depend on the distance, connect time and speed of transmission.

Appendix A26

THE NORDIC DATA NETWORK

1)

Introduction

The five Nordic Telecommunications Administrations (Iceland, Denmark, Finland, Norway and Sweden) have a long history of joint co-operation on telecommunications matters, formalized as far back as 1917. In June 1971 they held a meeting in Iceland and first discussed the matter of a joint Data Network. Since then various committees have looked into the need, and considered the user and technical requirements. In October 1974 it was decided to accept the proposals put forward by the committees and to send out invitations to tender to manufacturers. However, the network will only be implemented by four countries as Iceland decided not to join but retained the option of joining at a later date.

The reasons for developing a public data network in the Nordic countries were:

1. The current network facilities (i.e. the PSTN) are unsatisfactory for users because the data speeds are too low, the call set-up time is too long and the error rates are high.
2. If a user chooses not to use the PSTN for the above reasons, his only other choice is to lease private circuits. From the user's point of view, private circuits are expensive if they are not heavily used and inflexible - it takes a long time to change a configuration. From the PTTs point of view, planning the installation of private circuits requires considerable effort and the maintenance costs are very high.
3. In addition, the Eurodata (1972) forecasts for data transmission requirements in the 1980s show approximately a tenfold increase in both terminal installations and tariff volume in Scandinavia. So the problems outlined in 1 and 2 are likely to increase.

For these reasons it was decided that a separate data network would be required to cover the needs of the 1980s and that it should be flexible enough to be extended for the needs of the 1990s. The network is due to go into initial operation in 1978. Although the network is being designed jointly by four administrations it will effectively be four networks operated and managed by the respective administrations. Co-ordination of day-to-day management will be at the same level as PSTN co-ordination. Development of the network will be guided by the Nordic Telecommunications Conference and its attendant committees.

Concerning future development, a study is under way to evaluate the possibility of offering packet switching services on the network, which at present is designed to be circuit switched. Thereby, connection to Euronet and other packet switched public data networks in Europe will be possible. Discussions for connection to the German Public Data Network are also underway, particularly since the German network is also circuit switched.

2)

Configuration of Network

The network will be "a fully synchronous switched network based on integrated switching and transmission (IST) using time division multiplexing (TDM)", i.e. a circuit switched network.

The data network is built up of a number of components connected to each other as shown in diagram A26.1. The main component is the Data Switching Exchange (DSE). The DSE will be supplied by L M Ericsson, based on their AXE 30 electronic switching exchange. The DSEs are connected to each other by means of TDM high speed lines (64 Kbits/second).

The other components are;

DCC	-	Data Circuit Concentrators
DMX	-	Data Multiplexers
RMX	-	Remote Multiplexers
CMX	-	Customer Multiplexers
DCE	-	Data Circuit Terminating Equipment
DTE	-	Data Terminal Equipment
DPC	-	Data Processing Centres.

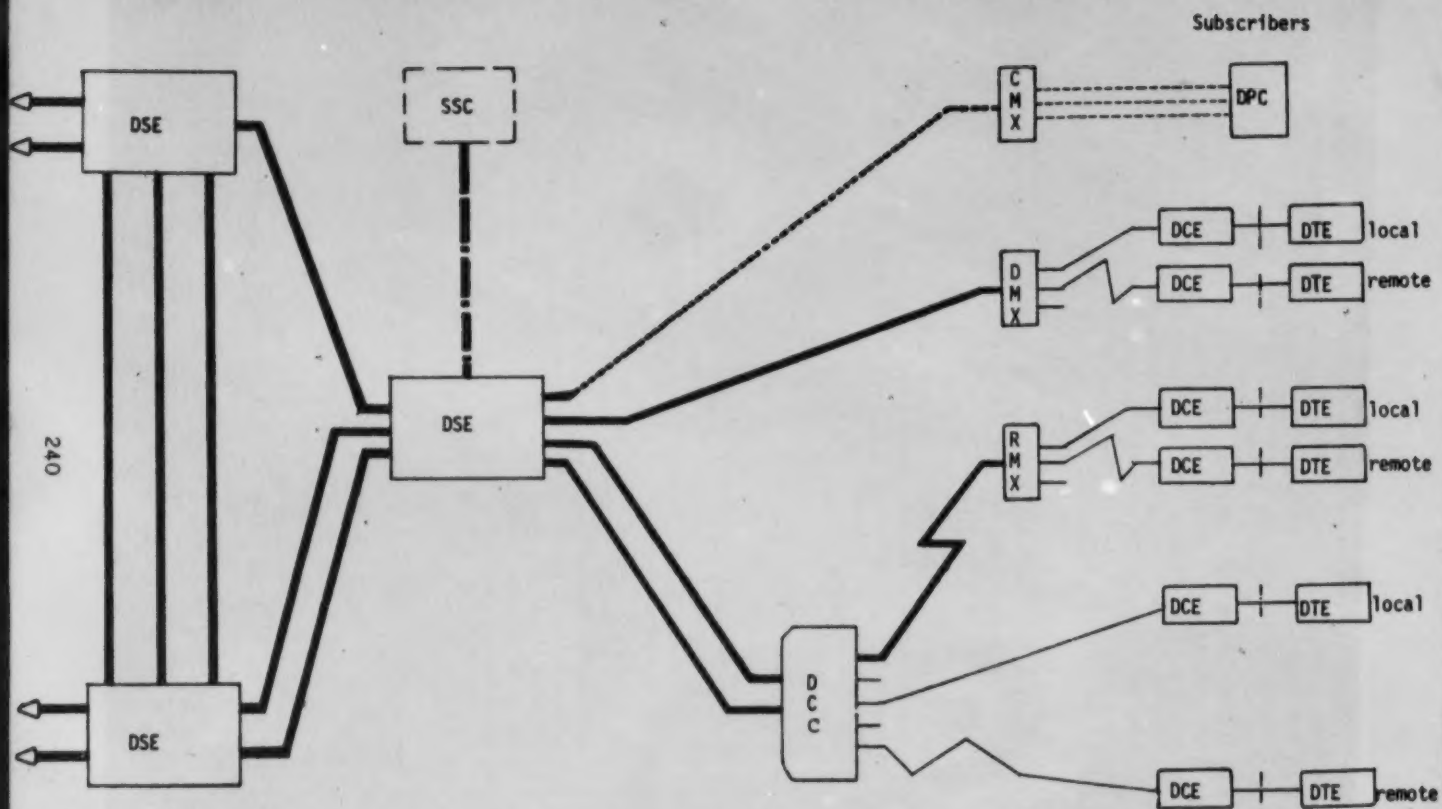


Diagram A26.1 The main components in the Nordic Public Data Network

Users will be able to make calls from DTEs to DTEs (or DPCs) of the same speed category.

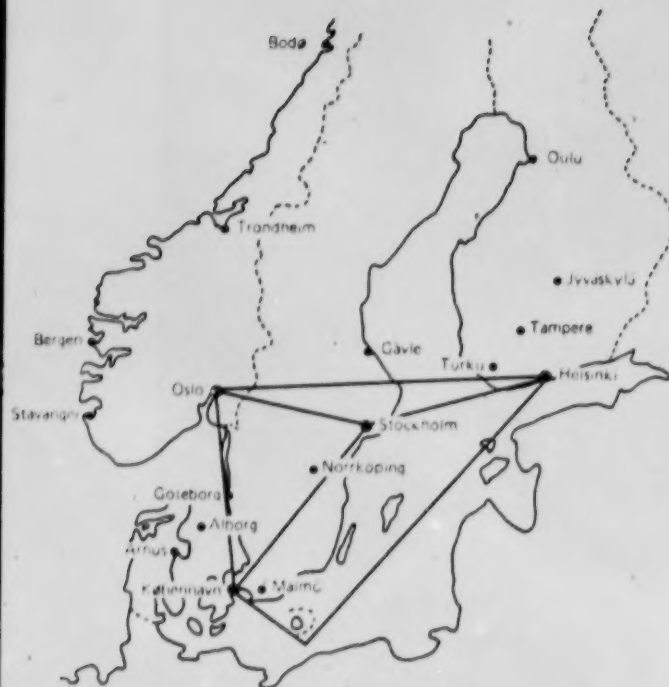
The Nordic administrations have implemented CCITT recommendations as far as possible and as such will be offering 5 types of DCEs. (A DCE is the interface equipment between the users terminal and the network and also includes 'modem' type equipment where necessary).

1. DCE-VC: for asynchronous terminals operating at speeds of 50, 110, 134.5, 200 and 300 bits per second. However these will have no number selection facilities, i.e. they will be automatically connected to a particular computer.
2. DCE-VPC: As above but including a number of selection facilities by means of a keyboard pad connected to the DCE.
3. DCE-V: For the normal CCITT V series interfaces for terminals operating at speeds of 600 bps upwards, but with no number selection facility.
4. DCE-VP: As above but with number selection facility.
5. DCE-X: For terminals designed for X21 interface. These terminals will be able to make number selection from the terminal keyboard.

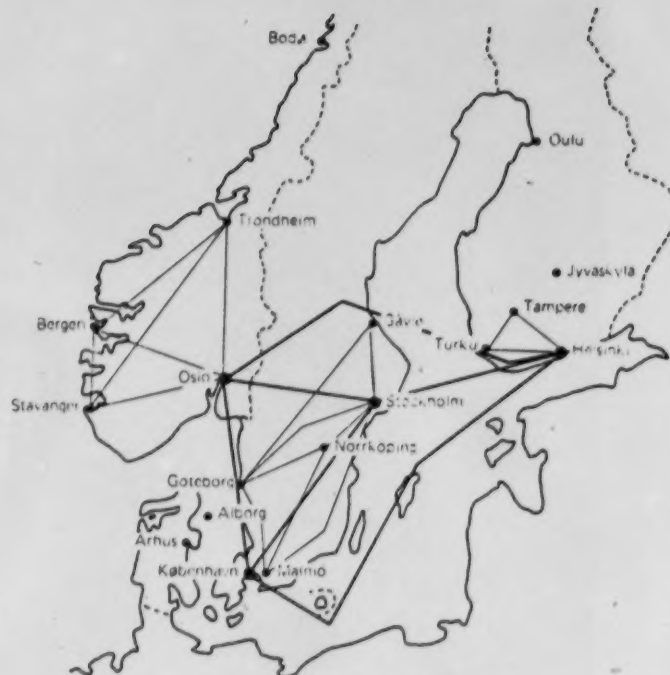
The network is designed for speeds of 600, 2400, 4800 and 9600 bps synchronous transmission. The asynchronous terminals will have their data converted to 600 bps synchronous transmission by the DCE.

Naturally, any terminal or computer make adhering to the CCITT recommendations is suitable for connection to the network.

The locations of the DCEs in 1980 and 1985 are shown in diagram A26.2. The location of the concentrators and multiplexors is not relevant because the cost of connection to the network will not be dependent on location.



Planned network in 1980



Possible network in 1985

Diagram A26.2

The Nordic Public Data Network

However the total quantity of equipment in 1980 and 1985 will be:

	<u>1980</u>	<u>1985</u>
DSE	4	13
DCC	88	271
DMX/RMX	84	266
DCE	11,400	55,100

Access via the PSTN will not be available. The Nordic data network is a separate network and therefore every customer will be directly connected - just like connecting a telephone line on the PSTN.

3) Applications

The network is a transmission medium for users of data communications and therefore can be used for any application. However, the attitudes of the different Nordic Administrations will influence the usage of the network. As already mentioned, the network must be considered as four separate networks built on a joint base. For example, the Swedish Administration has decided that, initially at least, if users want private dedicated circuits these will be provided on the telephone network as before, whereas the other three administrations will probably supply such circuits from the data network.

4) Security and Privacy

Since the Nordic Administrations follow most CCITT recommendations, and since one of the Administrations, Sweden, is in a country where security and privacy control is taken with the utmost seriousness, it is not surprising that a great deal of thought has gone into the access control facilities. These are some of the facilities available:

Closed User Group

A group can be formed (of terminals and computers) such that an outsider to the group cannot access the group and members of the group cannot access facilities outside the group. It is effectively a private switched data network. A terminal could belong to more than one group.

Direct Call and Selective Direct Call

If the terminal only accesses one other terminal then a direct call facility can be programmed into the network - this means that when the user requests a call he is automatically connected to his end point. The Selective Direct Call facility is an extension of this idea, whereby a terminal can be restricted to a calling a limited number of other terminals, but it is only available for up to 8 addresses.

Outgoing or Incoming Calls Barred.

This facility prevents terminals or computers from either making calls or receiving them.

Calling Line Identification

The network transmits the address of the calling subscriber to the called subscriber before the call is connected through. If the called subscriber does not wish to accept the call he can clear immediately. The facility is intended to give the subscriber the possibility of checking identities and since it is the network that passes the identities, the calling subscriber has no opportunity for falsifying his identity.

Called Line Identification

Similar to above but the network passes back to the caller the identity of the called subscriber.

International Calls Barred

Prevents international connections to a terminal, particularly important when a database has been restricted for National use only (i.e. in Sweden).

The last three facilities discussed will not be available yet during the ISL (initial service level) but only when the FSL (full service level) is implemented.

5) Traffic Types

Not applicable.

6) Financial Aspects

No information was available on the costs of implementing or operating the network.

The actual tariffs to be charged will be different in each country. However, the philosophy of charging is as follows:

- 1) Connection Charge - Independent of distance but probably dependent on user data signalling class
- 2) Rental - As above
- 3) Fixed Call Charge - A call is charged even if it does not result in a connection. There is a minimum time charge of 5 seconds
- 4) Traffic charge - may depend on:
 - duration
 - distance between data equipment
 - time of day/week
 - user data signalling speed
 - data volumes transmitted.

Preliminary (1976) costs for Sweden are given in Table A26.1. The charge is not volume sensitive but speed sensitive (very similar).

Table A26.1 Preliminary charges for the Nordic Data Network in Sweden

Transmission speed (bps)	Initial charge(SKr)	Charge per quarter(SKr)	Charge per call (SKr/min)			
			Calls within Sweden			Calls to other Nordic countries
			<45km	45-270km	>270km	
600	1000	400	.04	.09	.13	.19
2400	2000	900	.16	.36	.52	.75
4800	3000	1300	.32	.72	1.04	1.50
9600	5000	1900	.64	1.44	2.08	3.00

Note : Five second minimum charge per call or call attempt.

An example of a tariff comparison:

For a 2400 bps line 100Km long with a 4-wire connection within Sweden:

- Monthly rental of line + 1 modem = 1320 SKr
- For a 2400 bps connection to Data Network the traffic volume per month for 1320 SKr = 47 hours (including monthly rental)

i.e. For less than 47 hours/month Network cheaper
For more than 47 hours/month Line cheaper.

Note: Connection charges have not been included for either option.

Summary - TRANSPAC

NETWORK OPERATOR

The French Public Data network will be managed by a private company called TRANSPAC, 72% of whose shares will be owned by the Government.

USERS

The network will initially only be available to users in France.

APPLICATIONS

The TRANSPAC network will be suitable for all types of applications

FUTURE DEVELOPMENTS

Operation of the network should begin in 1978, and plans are under study for interconnection with other networks.

PRINCIPAL CHARACTERISTICS

TRANSPAC will be a packet switched network with two types of access points; switching nodes and concentrators. Initially there will be 4 nodes but by 1980 25 nodes and 6 concentrators will have been installed. Each node will be connected by at least two 72000 bps lines to other nodes, and data communication will eventually be offered at speeds from 50 to 48000 bps.

HETEROGENEITY

Network access will be available by direct connection or via public switched facilities. Technical connections will be either asynchronous terminals or X25 terminals (or computers).

SECURITY OF SERVICE

The network will offer a high degree of security, using such measures as user identification, passwords and closed user groups.

COSTS

Operational and implementation costs were not available. The provisional tariffs for using the network have been published and have three components: a connection charge, a rental charge and a usage charge. The usage charge will be distance independent, but will depend on volume of data transmitted and connect time.

Appendix A27

TRANSPAC - THE FRENCH PUBLIC DATA NETWORK

1)

Introduction

TRANSPAC will be the French Public Data Network based on packet switching technology and the CCITT X25 protocol. The French PTT have decided to implement a public data network primarily to meet the forecasted demands for data transmission in the 1980s and after, as it is estimated that from 1975 to 1985 there will be a 25% per year growth in the number of data terminal installations in France. In addition it is felt that the TRANSPAC approach will:

- cope with the large diversity of applications and systems,
- better utilize the means of transmission by taking into account the idle periods of data communications,
- provide data switching facilities,
- introduce very high guaranteed performance and security,
- be affordable by medium and small scale users,
- promote decentralization by offering a distance independant tariff,
- bring nearer the interconnection of data equipment of different makes,
- offer a service in accordance with international standards.

The network will be managed by a private company called TRANSPAC. However, some 72% of the shares will be owned by the Government and the remaining 28% by users, manufacturers, etc. The company does not exist as yet. TRANSPAC will manage the day-to-day

operation of the network and its board will be able to decide on possible future plans for extension, but since the majority of shares are owned by the French Government, all decisions will have to be ratified by the appropriate ministry.

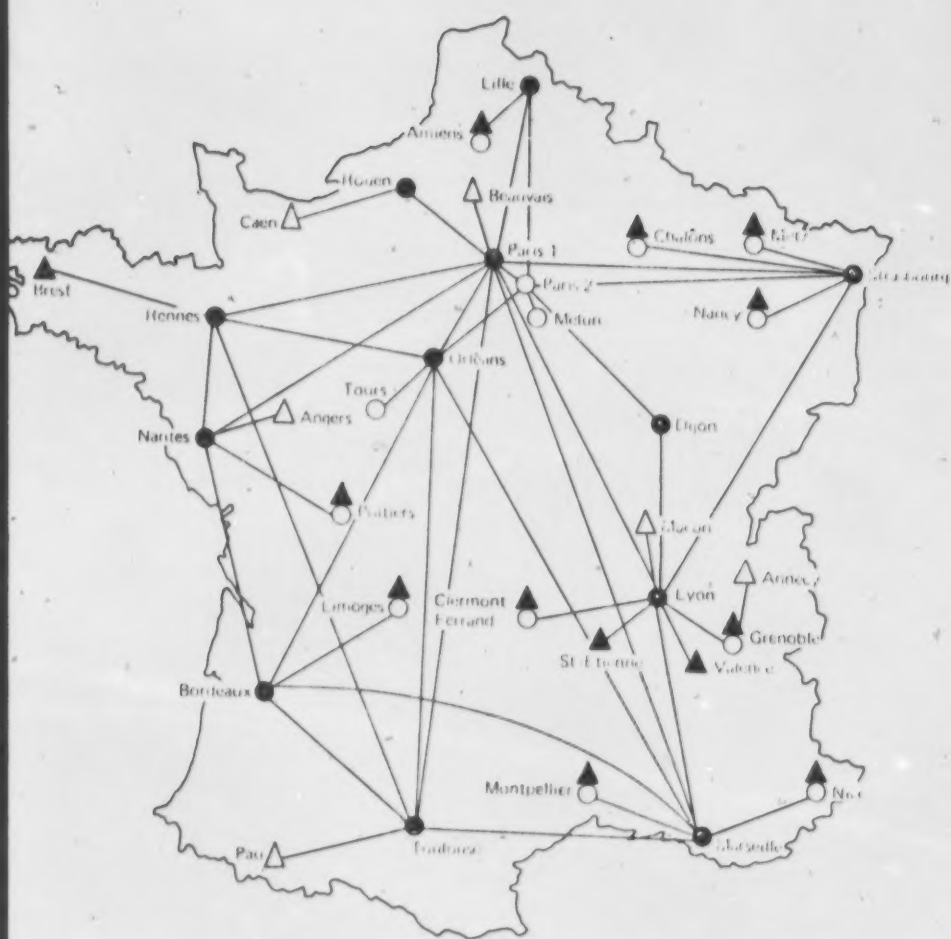
Current plans for interconnection with other networks are under study. The present concern is for the interconnection to other X25 packet switching networks, possibly via an international gateway.

Clearly EURONET will not pose serious problems since EURONET technology will be based on TRANSPAC. In addition, serious study is being made into the connection with DATAPAC, the Canadian Public Data Network.

2) Configuration of Network

The TRANSPAC network will be a packet switched network with two types of access points; switching nodes and concentrators. In June 1978 there will be 4 nodes but by the end of 1978 there will be 12 nodes and 12 concentrators; by 1980 these figures will change to 25 switching nodes and 6 concentrators. Each node will be connected by at least two 72000 bps lines to other nodes but the total meshing will be considerable, making the availability very high. The network configuration is shown in diagram A27.1.

Users will eventually be offered access communications at speeds from 50 to 48000 bps. Access will be available either by direct connection or via the public telex or telephone networks. Access via the telex network will be up to 50 bps and via the telephone network up to 300 bps (asynchronous). With each of the three categories, customers will be offered either a switched facility or a direct connection (called a permanent virtual circuit). In the case of a direct connection to TRANSPAC the permanent virtual circuit is obvious; a call request will initiate a connection to a predetermined point. Alternatively, a switched direct connection will allow the user to request a call set-up to a particular address. Users accessing TRANSPAC via the telephone or telex network, will dial a TRANSPAC access point. If they have a permanent virtual circuit (Private Port) they will be automatically



1978-1980

- ○ Packet-switching exchanges
- ▲ △ Other points of access
- High-speed circuits

Diagram A27.1

Implementation of TRANSPAC network

connected to a predetermined address. If, however, they have a general use port, they will then be able to make a call request to an address within the network.

There will be two types of technical connections to the network, either asynchronous terminals or X25 terminals (or computers). Furthermore, neither the French PTT nor TRANSPAC will provide customer interfaces for X25. This means that customers will have to provide their own interfaces. So far only IBM, of the manufacturers, has made an official announcement that they will provide X25 support for connection to TRANSPAC. However, the support will only be given for IBM networks using their own SNA (Systems Network Architecture) and will only allow SNA terminals to access SNA computers. This policy has to be viewed in the light of the TRANSPAC objective of allowing the interconnection of equipment of different makes. Other manufacturers are studying the requirements of X25 interfaces. In addition, certain other companies are likely to offer "black box" interfaces, e.g. Telenet. As a result of using the X25 protocol and the network's objective of offering speed and code conversion, it should be possible to allow equipments of different types to communicate with each other.

3)

Applications

The TRANSPAC network is a very ambitious project and will be suitable for all types of applications. The ultimate factor deciding which types of applications will be used on TRANSPAC will be the tariffs (see section 6). However, one interesting addition was a statement made in September 1977 during SICOB, the French Computing Fair. It was stated that after TRANSPAC became available private networks would be discouraged, and the possibility of increased tariffs for private telephone circuits should not be excluded as a means of discouragement.

Initially at least, the network will only be available in France. Since the tariffs will be distance independent, it can be expected that the geographical distribution will only depend on the location of business centres, and that many small users at long distances from computer centres may find use of the network economical.

So far there have been quite a few enquiries about using TRANSPAC but, since the operating company does not yet exist, there are no confirmed users. By the end of 1978 the network will be capable of handling 750 asynchronous terminals and 750 X25 terminals (or computers). However, the forecast for this number of connections is for mid-1977. Initially, the largest group of users may well be government departments, who will probably be under pressure to use the new national network.

4) Security and Privacy

The network will offer a high degree of security for subscribers. Firstly, the user will always be able to have the classical means of identification numbers and passwords. Users will also be able to form closed user groups, effectively creating a private switched network.

The closed user group option will be very flexible. Firstly a user can belong to more than one group and secondly he may choose to form a user group only for incoming calls, not outgoing calls.

5) Traffic Types

Not applicable.

6) Financial Aspects

The costs of implementing and operating the network were not available.

Tariffs have been published for use of TRANSPAC although they may change (by $\pm 10\%$) before the network becomes operational.

Table A27.1 TRANSPAC Tariffs

Dedicated Line Access

<u>Throughput Class</u>	<u>Monthly Rental</u> (FF)	<u>Permanent Virtual Circuit Rental</u> (FF)	<u>(OR)</u>	<u>Call Duration Charge</u> per min
Up to 300 bps	270	90		0.01
600 bps	570	90		0.01
1200 "	600	90		0.01
2400 "	650	180		0.02
4800 "	680	270		0.03
9600 "	750	360		0.04
19200 "	800	720		0.08
48000 "	1300	-		-

In addition there is a volume charge of 0.05FF per Kilo-octet.

Switched Network Access

	<u>Private Port Rental</u> 180F/Month	<u>General Use Port. Duration Charge</u> 0.05 F/Minute
Telephone Access		
Telex Access	280 F/Month	0.08 F/Minute

In addition there is the same volume charge as for dedicated line access.

Off Peak Discounts

(Applicable only to volume charge and duration charge for dedicated line access).

	8AM-7PM	7PM-12PM 6AM-8AM	0AM-6AM
Working Days	-	40%	80%
Saturdays	40%	40%	80%
Sundays & Holidays	80%	80%	80%

Summary-DATEX

NETWORK OPERATOR

Datex is the new German public circuit switched network, operated by the Deutsche Bundespost. The Datex-service shall be integrated in a network for all digital services (IDN).

USERS

Of the 165 subscribers at present using the Datex 2400 service the majority are lorry freight operators.

APPLICATIONS

The IDN network will be suitable for all types of applications.

FUTURE DEVELOPMENT

The introduction of a 4800 bps and a 9600 bps service is planned for 1978. In addition, the DBP will offer a packet switched service through its future services (IDN) and the resulting technical problems are being studied.

PRINCIPAL CHARACTERISTICS

The exchanges are based on Siemens Electronic Data Switching (EDS) technology, and in May 1977 had a total capacity of 75000 lines. EDS services then offered were 50 baud telex, 50-200 baud data and 2400 bps data services. By 1980 exchanges will be operating in 18 locations.

HETEROGENEITY

Access to the network must use CCITT interfaces. However the network does not provide for code conversion and so communicating terminals must be compatible.

SECURITY OF SERVICE

Security measures offered in the IDN network include closed users groups, direct call and calling line identification.

COSTS

The cost of implementing the network will be about DM 1000m by 1980. The charging structure of the network includes a connection charge, a monthly rental and a usage charge which depends on distance, user speed and duration of call.

Appendix A28

DATEx - THE GERMAN FR PUBLIC DATA NETWORK

1)

Introduction

Datex is the new German public circuit switched network operated by the Deutsche Bundespost. The Datex-network shall be integrated in a pcm-based network for all digital services (IDN). It is often referred to as the EDS (Electronic Data Switching) network, which is strictly speaking incorrect, as EDS is the name of only the switching technology and equipment employed. The IDN network is based on electronic switching systems which are gradually being installed to replace previous electromechanical systems. The first EDS switching centre began operating in Mannheim in May 1975. By November 1977 13 exchanges were in operation. By 1980 EDS switching centres will be operating in 18 locations. Access via EDS to Euronet is foreseen and interworking with other public data networks is under discussion (eg. the Nordic and Swiss networks).

2)

Configuration of Network

A map showing the location of present and planned switching centres within the Federal Republic of Germany is shown in figure A28.1.

The exchanges are based on Siemens EDS switching technology. In May 1977 the exchanges installed had a total capacity of 75000 lines. EDS services then offered were:

- 50 baud telex service
- 50-200 baud data service
- 2400 bps switched service.

By the end of 1977/beginning of 1978 a 4800 and a 9600 bps service will be introduced on an experimental basis. For 1978 the introduction of a 300 baud service is also planned.

- Data switching exchange planned
- Data switching exchange in operation
- expected opening date

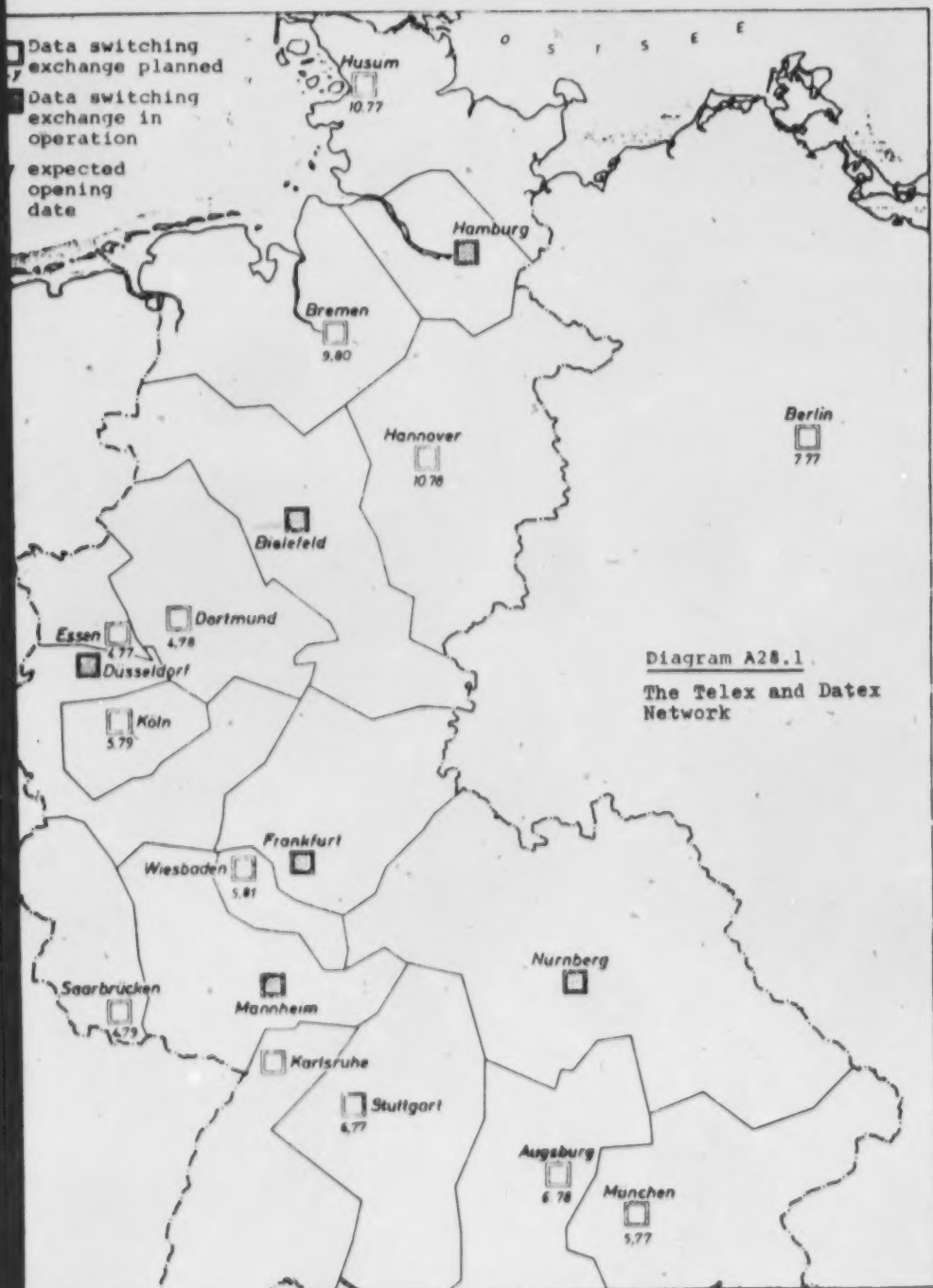


Diagram A28.1
The Telex and Datex Network

Datex will offer a series of special services such as direct call, closed user groups, abbreviated address calling, multi address calling, calling line identification, circular sending, keyboard selection. Of these, some are already offered, e.g. keyboard dialling and closed user groups. Others will be offered by 1980. The DBP believe that the closed user group service offers particular advantages to subscribers who have high security requirements.

Later on (about 1980) the Deutsche Bundespost will offer a packet switched service - the technical problems are now being studied.

3) Applications

The DBP judge their customer's reaction to Datex as positive, particularly now that initial difficulties have been overcome and as the special services become available. So far about 1,200 Datex subscribers have been transferred to the new EDS. The Datex 2400 service is used by 165 subscribers end of 1977. The majority of these (about 100) are lorry freight operators who participated in the experimental service which preceded the now official service. The other 20 users are banks and various commercial organisations.

4) Security and Privacy

The DBP believe, of course, that the users of their network should be responsible for complying with requirements laid down by the German Data Protection Law.

Security measures offered in the Datex network include the closed user group facility already mentioned. This facility is considered absolutely secure because of various testing procedures used, such as terminal check and recheck. Being a public network, security is also higher in case of breakdown as fallback lines are available. Other facilities include direct call and calling line identification.

5) Traffic Types

Not applicable.

6) Financial Aspects

The cost of implementing the network will be about 1000 million DM by 1980. This figure does however, include the cost of integrating also the large telex and the smaller Datex 200 service. The budget for switching equipment for each of the years 1976, 1977 and 1978 amounts to 120-150 million DM and for transmission equipment to DM 65-75 million.

The charging structure for network usage includes a once-only connection charge, and monthly rental and a usage charge which depends on distance, user speed, and duration of call. Charges are detailed in Table A28.1.

Table A28.1: Tariffs IDN Network (Datex Connections)

a) Connection and Rental Charges (DM)

<u>Speed (bps)</u>	<u>Connection Charge</u>	<u>Rental/ Month</u>
200	200	200
300	200	170
2400	400	200

b) Usage Charges (DM/minute) according to Distance and Speed.

Speed	Within Exchange	Up to 20 km	20-40 km	50-100 km	Over 100 km
200	0.28	0.28	0.43	0.73	0.95
300	0.28	0.28	0.43	0.73	0.95
2400	0.32	0.32	0.50	0.86	1.13

Note: Reductions of between 50% and 75% apply for off-peak traffic (1800 to 0600).

Summary - RETD

NETWORK OPERATOR

RETD (Red Especial de Transmision de Datos) is operated by CTNE, the Spanish Telephone Company.

USERS

The majority of network users are banks, though it is a public network.

APPLICATIONS

The main application supported by the network is finance.

FUTURE DEVELOPMENTS

Future plans include upgrading of circuit speeds, hardware improvements, adoption of X25 interface standards, interfaces with the switched telephone and telex networks, and the provision of facilities for RJE and timesharing.

PRINCIPAL CHARACTERISTICS

The switching centres are accessed via Network Entry Points. Currently there are 25 concentrators at 10 entry points. The circuits between the centres operate at 4.8 kbs, with 9.6 and 48kbs planned for the future. At present there are about 3500 terminals accessing RETD through the concentrators.

HETEROGENEITY

RETD is connected to the RECORD III message switching network which connects the French SESAME and Italian IRICON networks. At least 7 different terminal types are supported by RETD.

SECURITY OF SERVICE

Security will be provided by means of closed user groups.

COSTS

The costs for implementing and operating the network were not available. The tariffs for using the network are made up of three elements: a connection charge, a rental charge and a usage charge.

Appendix A29

RETD - THE SPANISH PUBLIC DATA NETWORK

- 1) RETD (Red Especial de Transmision de Datos) is operated by CTNE, the Spanish Telephone Company. CTNE implemented the network for the following reasons:
 - 1) To offer an economic and more acceptable service (insistently demanded by a great number of users) in which the charges would be allocated in accordance with the use being made of the network at any given time.
 - 2) To make available teleprocessing services to historically backward regions and therefore to contribute to their development.
 - 3) To avoid the setting up of private networks with the resulting inconveniences, such as a proliferation of different standards, protocols and formats.

The network has been operating since 1971.

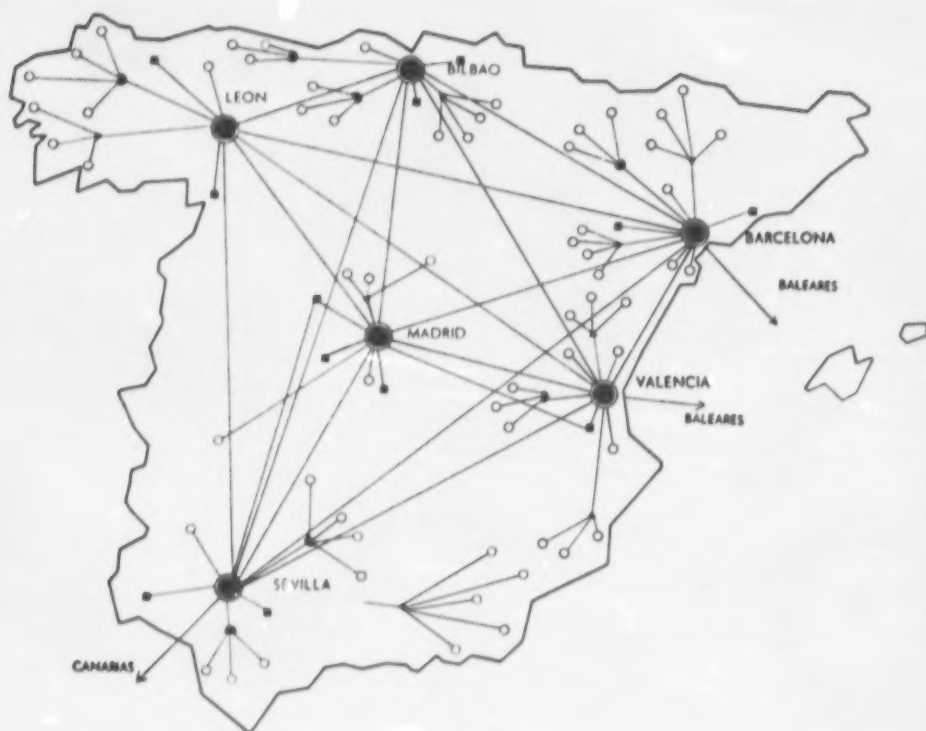
RETD is currently connected to the RECORD III message switching network which connects the French SESAME network and the Italian IRICON network. In addition plans are under way for improving the network and implementing the CCITT X25 standard.

2) Network Configuration

RETD was the first public data network to use packeting techniques, with two switching centres located in Madrid and Barcelona. The centres are accessed via Network Entry Points. Currently there are 25 concentrators at ten network entry points. By the end of 1978 there will be 30 concentrators at 12 entry points. The entry points are located in the capitals of provinces and important cities. A map showing its present and planned configuration is given in Diagram A29.1.

Diagram A29.1

The future configuration of the R E T D Network



The circuits between the centres are currently 4.8 kbs, with 9.6 and 48 kbs planned for the future. Other plans under consideration for the network include hardware improvements, adoption of X25 interface standards, adaptive routing, interfaces with the switched telephone and telex networks, provision of virtual call and datagram service and the provision of facilities for remote job entry and timesharing.

Terminals access RETD through concentrators which are programmed to support and control them; currently at least 7 different terminal types are supported.

3) Applications

When first set up in 1971, the network provided only real-time point-to-point service. Bulk data and message transmission were added later. Specialised terminals are offered for banking applications.

By 1975 usage of the network averaged 193 million bits per day, a 20-fold increase on the previous year. About 3718 terminals are now accessing the network, mostly belonging to banks.

4) Security and Privacy

Protection against unauthorised access to messages or routing errors is provided by the information contained in packet headers and by control exercised over subscribers' private networks. Additional access control will be offered in the form of closed user group options.

5) Traffic Types

See Section 3.

6)

Financial Aspects

The costs for implementing and operating the network were not available.

The tariff of RETD is made up of three components:

- 1) a once only connection charge which depends only on whether the terminal is located in the same zone as the network entry point or not,
- 2) a monthly rental charge which depends on the quality of circuit required for connection to the network and the distance to the nearest network entry point. Users are charged for the distance to nearest designated network entry point irrespective of whether it exists yet or not. In this way, subscribers in underdeveloped parts of the country are not penalised,
- 3) a usage charge based on four factors:
 - origin and destination (in three zones: provincial, regional and national)
 - time of day
 - volume of data transmitted
 - a charge per message.

Table A29.1:

RETD-Connection, Rental and Usage Charges (Pesetas)

a) Connection and Monthly Rental Charges for 200 baud Circuits

Distance to network entry point (note 1)	Connection charge (2-wire)	Rental 2-wire
-----	-----	-----
1	17006	3625
2	34012	4438
3.1	34012	6974
3.2	34012	8342
3.3	34012	10395

Note : 1. Connection and rental charges depend on the distance between the terminal and the nearest network point of entry. Distances are classified as follows:
 Zone 1, terminal in the same centre:
 Zone 2, terminal in a different centre, but in same district or urban area:
 Zone 3, terminal in a different district,
 Zone 3.1, between urban areas and peripheral districts, between peripheral districts, or between adjoining districts, Zone 3.2, between unadjacent districts when the distance is up to 20km, Zone 3.3, between unadjacent districts when the distance is 20-100km.

b) Connection and Monthly Rental Charges for Telephone Circuits

Distance to network entry point (note 1)	Connection charge (2-wire)	Connection charge (4-wire)	<u>Normal quality</u>		<u>Special quality</u>
			Rental 2-wire	Rental 4-wire	Rental 4-wire
1	17006	34012	2992	4698	4358
2	34012	68024	16438	18144	24658
3.1	34012	68024	17432	19138	38738
3.2	34012	68024	30894	32600	46342
3.3	34012	68024	38499	40205	57749

Note : 1. Connection and rental charges depend on the distance between the terminal and the nearest network point of entry, according to the zones shown above.

c) Usage charges per 1000 characters for Inland Calls
(Real Time Service and Auxiliary Message Service)

Zone	Rate 1	Rate 2	Rate 3
	0800-1400 Mon-Sat	1400-2400 Mon-Sat	0000-0800 Mon-Sat all day Sun
-----	-----	-----	-----
Provincial	2.01	1.11	0.79
Regional	3.99	2.23	1.60
National	6.16	3.45	2.47
Charge per message:	0.092	0.073	0.073

Note : 1. Call charge depends as shown on the call distance with zones classified as follows: Provincial - in the same province, Regional - not in the same province but in the same telephone area, National - in different telephone areas.

d) Usage charges for Bulk Data Transmission Service
(per 1000 characters)

Zone	Rate 1	Rate 2	Rate 3
	0800-1400 Mon-Sat	1400-2400 Mon-Sat	0000-0800 Mon-Sat all day Sun
-----	-----	-----	-----
Provincial	.95	.57	.38
Regional	1.90	1.14	.76
National	2.94	1.76	1.18

Note : 1. Call charges depend as shown on distance, with zones classified as shown above.

Summary - EPSS

NETWORK OPERATOR

EPSS (Experimental Packet Switching Service) is operated by the British Post Office.

USERS

The network is used by organisations operating in such fields as commerce, government, research and banking. It is intended to be a fully public data network.

APPLICATIONS

EPSS is suitable for all types of applications.

FUTURE DEVELOPMENT

The British Post Office has had considerable discussions with other PTTs concerning interconnection of EPSS with other public data networks, primarily in the USA. The Post Office have announced plans to offer an X25 network in the future.

PRINCIPAL CHARACTERISTICS

The network consists of three packet switching exchanges sited in London, Manchester and Glasgow, and offers user access at speeds 50, 110, 300, 2400, 4800 and 48000 bps.

HETEROGENEITY

Network access is available via direct connections to the PSE or by a dial-up connection over the PSTN. Packet switching units are based on Ferranti Argus 700E processors.

SECURITY OF SERVICE

Security is offered by various facilities including terminal identification and closed user groups.

COSTS

The cost of operating EPSS is not published by the Post Office. Provisional charges for use of EPSS are made up by three components: a connection charge, a rental charge and a usage charge. The usage charge is distance independent and will be sensitive to volume of data transmitted and duration of call.

Appendix A30

EPSS

1)

INTRODUCTION

After some months of pre-operational testing the Experimental Packet Switched Service (EPSS) was formally opened in April 1977. The purpose of the experimental operation is to evaluate the technical and commercial advantages of the service. Recent developments indicate that EPSS may be replaced or run in parallel with a new packet switching service based on the more recent CCITT X-25 standard.

The British Post Office has had considerable discussions with other PTTs about the interconnection of public data networks. The plan is to design an international gateway in London through which to connect to other networks, primarily in the USA, conforming to international standards. The Post Office reserves the right to withdraw or radically alter the service, at a minimum of 12 months notice.

2)

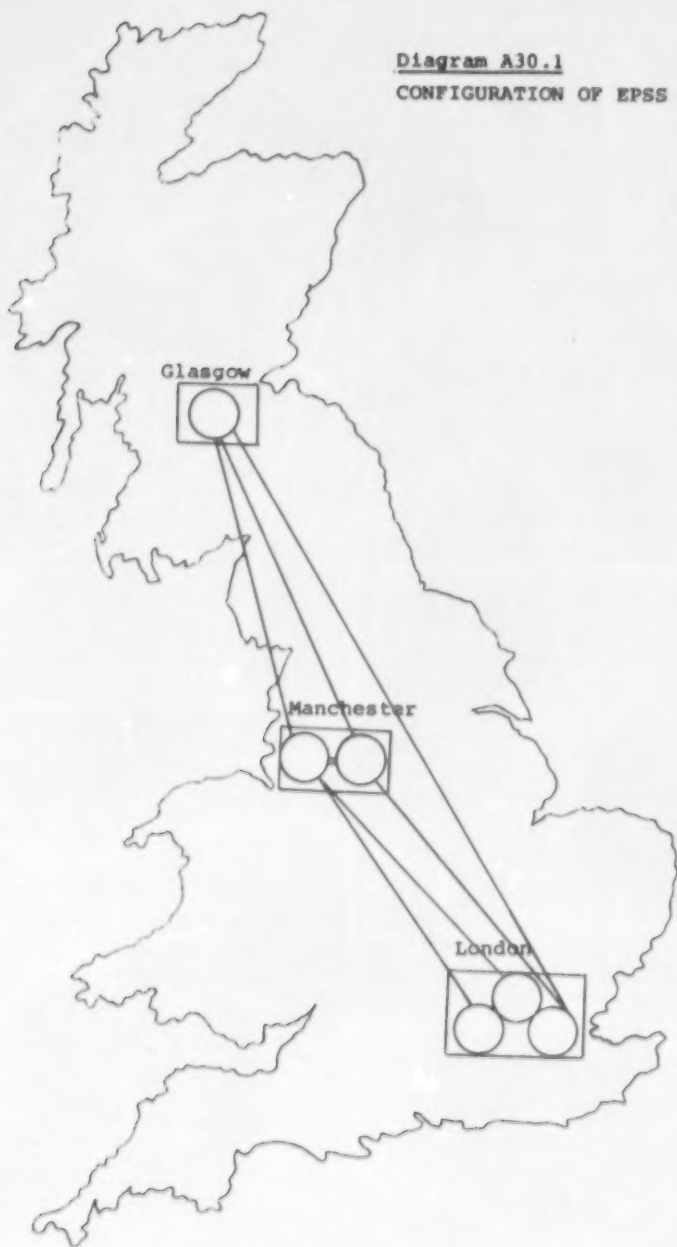
Configuration of the Network

The EPSS network consists of three exchanges (PSEs) sited in London, Manchester and Glasgow. Packet switching units are based on Ferranti Argus 700E processors. The specifications for EPSS were originally drawn up in 1972 and so they do not provide for the more recently developed standard protocols.

EPSS has capacity for 57 packet terminals. Ninety character ports can be accessed via the PSTN which, assuming a 2 to 1 contention ratio will serve 180 character terminals. 21 character ports are also available for customers requiring direct connections to the PSE. By November 1977 users were connected to 42 packet ports and 81 character terminals were using the network.

EPSS offers user access at speeds, 50, 110, 300, 2400, 4800, and 48000 bps. The lower speeds are available to asynchronous terminals over either private circuits or a dial up connection over the public telephone network. Access for terminals which are not capable of working in packet mode is at

Diagram A30.1
CONFIGURATION OF EPSS



 Packet Switching Exchange

 Packet Switching Unit 271

present restricted to those using the International Telegraphic Alphabet (ITA) Nr 5. However, Telex access provided is for in-house use only.

3) Applications

The experimental service was set up in co-operation with about 40 organisations, a list of which is given in Table A30.1. As can be seen, these organisations operate in a large variety of fields, such as commerce, government, research, computer industry and services, and banking. The degree to which these organisations use EPSS varies considerably, some having full time staff committed to the network.

Academic organisations (Universities, Polytechnics, Research Centres) are the heaviest users of the network's services.

4) Security and Privacy

Security is offered by various 'facilities'; e.g.

- terminal identification, by checking the callers identity in terminal descriptors;
- closed user group, which technically prevents subscribers outside the group from accessing any of the group's connections.

5) Traffic Types

Not applicable.

Table A30.1: List of organisations participating in EPSS

AERE Harwell
Agricultural Research Council
Atlas Computer Laboratory
Civil Service Department
Computer Aided Design Centre
Daresbury Laboratory
Edinburgh Regional Computing Centre
GEC Computers Ltd
Hatfield Polytechnic College
ICL
IP Sharp Associates Ltd
Logica Ltd
Manchester Regional Computing Centre
Midland Bank Ltd
Ministry of Defence RSRE
National Computing Centre Ltd
National Engineering Laboratory
National Physical Laboratory
North Staffordshire Polytechnic
Paisley College of Technology
Post Office Data Processing Service
Queen Mary College
The Rutherford High Energy Laboratory
South West Universities Regional Computer Centre
Sperry Univac-London Development Centre
Sperry Univac Ltd
University of Cambridge
University College of London
University of Essex
University of Glasgow
University of Newcastle upon Tyne
University of Nottingham
University of Oxford
University of Sheffield.

Financial Aspects

The cost of operating EPSS is not published by the Post Office.

Trial tariffs have been announced for EPSS. For the first year of EPSS operation charges are only being made to cover participating customers access to the service. No charges apply for the transfer of packets.

The access charge can take one of three forms. Customers using the Datel 200 service pay standard modem and exchange line rentals, but all calls, except in a few cases where the calling location varies, are charged at local rates irrespective of distance. For direct connections over private circuits, the circuit and outstation modem are charged at 45% of the usual rental, but standard connection charges are payable, as too are standard charges for associated equipment or exchange lines. For access at 48000 bps, charges for circuits and outstation modems are 75% of the normal charges, with standard connection charges again payable.

After the first year of experimental service the tariffs shown in table A30.2 will apply. These are based on current costs and will be revised as and when other telecommunications charges are revised.

The charges for access using direct connections at 48000 bps will be specially assessed taking account of the mode of circuit provision, except for users who are already accessing in this way during the first year of experimental service who will continue to pay the same charges (i.e. 75% of the standard charges).

Table A30.2:

EPSS - Connection, Rental and Usage Charges (£Sterling)

a) EPSS Port Charges (including modem)

Port speed (bps) -----	Connection charge -----	Rental per month -----
Character terminal	25	1.67
2400	100	50.00
4800	120	62.50
48000	200	316.67

b) Charges for 2400/4800 access circuits

Distance from exchange -----	Connection charge -----	Rental per month -----
4	40	18.33
16	40	37.50
32	60	50.00

Notes:

1. Users of character mode dial-up terminals pay normal telephone and Datel 200 modem charges.
2. The modem at the user's premises is charged at the standard rate in addition to the charges shown here.

c) Charges for inland calls

Rate per
kilopacket

.95

Notes:

1. Charge based on a minimum of four packets per effective call.

2. Each packet totals a maximum of 255 8-bit bytes.

d) Charges for duration of usage

Access Mode

Rate per hour

Packet terminal

.10

Character terminal

.70

(notes 1 & 2)

Notes:

1. Telephone call charges are additional.

2. There is no additional charge for virtual calls from dial-up customers.

APPENDIX B

STUDY METHODOLOGY - BASIC DOCUMENTS

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1) Checklist of Information to be Sought on Networks	278
2) Questionnaire	280
3) Checklist of Information for Network Descriptions	286

Appendix B1

Checklist of Information to be sought on Networks

A. GENERAL BACKGROUND OF NETWORK

- Ownership
- Who operates/manages the network
- What are the "terms of reference" of the operator
- History of development of the network
- Future plans for network eg. links with other networks.

B. TECHNICAL DESCRIPTION

- Configuration of network
- Type and Speeds of data circuits
- Switching technology employed (including hardware employed)
- Location and types of Host computers on the network
- Numbers and types of terminals connected to the network in each country
- Other uses made of network (eg. voice/telex etc)
- Future development of network in terms of coverage, hosts and terminals supported, speed of data circuits etc.

C. APPLICATIONS

- Types of applications supported by network hosts
- Contents of data files (or databases) accessed by these applications
- Location and source of data stored
- Processing of data outside its country of origin

- Location of users of the applications
- Location of the hosts supporting the applications
- Volumes of trans-border data flow for the applications
- Format of transactions for each application
- Restrictions and controls for user access to the applications and data
- Relevance of national privacy and security laws.

D. TRAFFIC TYPES

- Types of traffic using the network
- Percentage of calls falling into each type
- Percentage of total volume falling into each type
- Total volume of traffic for each type.

E. USER COMMUNITY

- Who can access the network
- What controls are used to enforce access restrictions
- Geographical distribution of user community
- Reasons for users using international networks
- Reasons for users using particular network
- User requirements privacy and security.

F. FINANCIAL ASPECTS

- Cost of setting up the network
- Cost of operating the network
- Charging structure for network usage
- Sensitivity of network costs to PTT tariff structures.

Appendix B2

Questionnaire

This questionnaire is concerned only with data networks carrying communications between mainframe and mini computers (hosts) and data terminals. It is not concerned with telex or voice networks except to the extent that these share facilities with a data network. Please fill in this questionnaire for the data network owned and/or operated by

If we have left insufficient room for any of the answers, please attach continuation sheets.

If you have any published material which answers any of the questions, then please attach it.

May I thank you in advance for your co-operation on this study.

* * * * *

GENERAL

- 1 What is the name of the network ? _____
- 2 Who owns the network ?

- 3 Who is responsible for management/operation of the network ?

- 4 When did the network first begin carrying traffic ?

TECHNICAL DESCRIPTION

- 5 If possible, please attach a diagram of the network.
- 6 What type and speeds of data circuit are used in the network ?

- 7 To what extent are users able to access the network by dialling up over public switched facilities ?

- 8 Are the network circuits also used for voice and/or telex traffic ?

- 9 Is the network switched ? If so what switching technology does it use, and what hardware is used for the switches ?

- 10 How many terminals can access the network in each country which it covers ?

<u>Country</u>	<u>Number of and types of terminals</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

- 11 Where are the hosts with access to the network located ?
(The locations can be identified by number in the rest of this questionnaire.)

Location	Town	Country	Hosts (Make and Model Numbers)
1			
2			
3			
4			
5			

APPLICATIONS

- 12 What are the applications using the network, and which host locations support them ? (A simple description of each application is sufficient, for example "payroll", "order entry", "cheque clearing", "scientific information retrieval". The applications can be identified by number in the rest of the questionnaire.)

Application Number	Description	Location of Hosts Supporting the Application
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

- 13 In which countries are the users of each application located, and which host locations do they access for the application ?

Country	Applications Used	Host Location Accessed

- 14 What information is held in the data files and/or data-bases accessing the network for each application ?

Application	Information held
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

- 15 Can you estimate the percentage of calls and traffic in the following categories ?

	% of Calls	% of Traffic	Traffic Volume/Year (Characters)
a Interactive Work			
b Batch Processing			
c Bulk Data Transfer			
d Message Switching			

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USER COMMUNITY

- 16 What type of persons/organisations may access the network ?

- 17 What controls are applied to restrict access to the network ?

- 18 What controls are applied to restrict access to specific applications ?

COSTS

19 What was the cost of implementing the network ?

20 What are the annual costs of operating the network ?

21 What, if any, is the charging structure for network usage ?

Appendix B3

Checklist of Information in Network Description

A) General

- Ownership
- who operates/manages the network
- Reasons for network development
- Brief description of network
- Network users
- Historical development
- Future plans

B) Configuration of Network

- Configuration of network
- switching technology
- type and speeds of data circuits
- type and speeds of terminals
- types of computers
- use made of network other than data transmission
- future technological development

C) Applications (International)

- Type of application
- users of applications and their locations
- contents of data files or description of application
- Location and source of data
- Volumes of data transmitted by application
- format of transactions

D) Security and Privacy

- Measures adopted for security of access to network, applications and data.
- Relevance , if any, of national privacy legislation

E) Traffic Types

- Types of traffic on network:
 - . bulk transfer
 - . batch
 - . interactive
 - . message switching
- Volumes of data transmitted internationally for each type

F) Financial Aspects

- Cost of setting up network
- cost of operating network (overall and line rentals)
- charging structure for network use